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# ***JPRS Report***

# **Science & Technology**

***Europe & Latin America***

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# SCIENCE & TECHNOLOGY EUROPE & LATIN AMERICA

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## FRG UNIVERSITY ACHIEVES 135K SUPERCONDUCTOR

Duesseldorf VDI NACHRICHTEN in German No 20, 15 May 87 p 27

[Article: "Superconductor for High Current: Transition Temperature Lies Within a Very Limited Area"]

[Excerpts] VDI-N, Bochum, 15/5/87--High temperature, high current superconductors with a transition temperature of 135 Kelvin (-138 degrees C) have now been developed by Dr Yunus Khan of the Institute for Electrotechnical Materials at the Ruhr University in Bochum. This temperature represents a peak in the constant competition for new records. At the same time, the Bochum researchers were the first to raise the maximum current from a few microamperes to more than 300 mA. According to Dr Khan, the transition to superconductivity is extremely rapid in the materials studied at Bochum, which means that the measured value can be averaged over a few degrees rather than over 50 or even 100 degrees, as has been the case up to now. This new development represents an important step on the way to technologically simple and cheaper applications of superconductive materials.

Dr Kahn was able to produce a high temperature superconductor with high current flow based on the known oxide mixture [barium, lanthanum, copper oxide] through special temperature treatment and the use of atmospheric pressure. "If we could succeed in further increasing the current, for example to several hundred amperes per square millimeter," Dr Kahn states, "it would mean a tremendous breakthrough in the area of applications." At the present time, superconductivity is used in medical technology, nuclear magnetic resonance tomography, and computer tomography, albeit to a limited extent because of the cost and the technical requirements for the use of liquid helium.

A durable superconductor starting at 77 K (-196 degrees C) and cooled with liquid nitrogen--which is cheap and available in practically unlimited quantities--would be the prerequisite for large-scale technical application of superconductivity in other fields. "We will now make a special effort to reach this goal through improvement of the current flow," says Dr Kahn. "The relatively simple technology used in Bochum makes us very optimistic."

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CSO: 3698/M289

## SUPERCONDUCTOR, CRYOELECTRICITY R&amp;D IN FRANCE

Paris L'USINE NOUVELLE (PRODUIRE Supplement) in French 14 May 87 pp 44-45, 47-48

[Article by Michel Vilnat: "Electricity From Cold"; boxed item by author; first paragraph is L'USINE NOUVELLE introduction]

[Excerpts] In the vicinity of absolute zero, some metal alloys and a few organic compounds become superconductors: They carry an electrical current with no loss or heat generation, and they generate very intense magnetic fields. These are properties which will turn the electrical industry upside-down.

Tomorrow's electrical technology will be "superconductivity," according to specialists at Alsthom. Cryoelectricity, as researchers call it, will revolutionize the technology of electrical devices in the 21st century.

At present, the most striking application of this physical phenomenon is in magnets. An initial electrical pulse is all that is needed. The magnetic field persists as long as the coil's temperature is maintained. Thus, for more than 9 years the magnet in the Big European Bubble Chamber (BEBC) at CERN [European Center for Nuclear Research] in Geneva has operated in its cryostat with no outside intervention.

Manufacturers are extremely interested in superconductivity. Alsthom, working with the Marcoussis laboratory, has built a superconductive wire manufacturing facility. These wires can carry alternating current, which is quite unusual. Indeed, for years it has been impossible to use anything other than direct current. Electromagnetic losses associated with alternating current were much too high. Today, Alsthom engineers are using a continuous process to produce a multifilament wire which can be used at 50 Hz. It has a diameter of 0.12 mm and consists of 14,496 0.55-micron filaments. Its losses are less than 100 W per cubic decimeter of wire at 1 tesla (at 50 Hz). Marcoussis researchers have even produced a 0.08-mm diameter wire bearing 254,100 niobium-titanium filaments. Each 800-angstrom filament is coated with cupronickel. The whole wire is then twisted to further reduce undesirable electromagnetic side effects.

The production of such wires has led to the building of the world's first superconducting transformer. With a capacity of 70 kVA, the total mass of its magnetic circuit is scarcely 52.4 kg (it would have weighed 700 kg using

conventional technologies). Its efficiency (99.7 percent) is slightly above that of conventional transformers (around 97.6 percent). But the most significant feature of this device is that it is autoprotecting. In case of a short circuit, the conductor shifts from the superconductive state to a "resistor" state in 50 microseconds and blocks the current. The only effect is the vaporizing of several cubic centimeters of helium. In the future the transformer will be no more than a link in the chain from manufacturer to consumer, in which nearly every element will be able to use superconductivity.

Several countries, such as the FRG, the USSR, Japan, etc., have built prototypes and are now developing cryoalternators. France, within the framework of an Alsthom-EDF [French Electricity Company] program, has operated the largest cryorotor built to date.

With a capacity of 250 MW, its mass is one-third less than that of a standard alternator and its losses are reduced proportionally. Only the rotor is a superconductor; the stator uses traditional technologies. With an extremely high efficiency (99.7 percent), a machine of around 1,000 MW should cost about 20 percent less than conventional alternators of the same capacity. A completely cryogenic apparatus would reduce the weight by another third and proportionately diminish losses, thus lowering the competitive threshold.

Cryoelectricity in the field of alternating current stirs the imagination of researchers working on active and reactive power regulators (RASC), pre-circuit breakers [predisjoncteurs] (DASC), rectifiers (REDASC), storage coils (LASC), etc. For example, the RASC is an assembly consisting of a superconductive energy storage coil connected to an ac-dc converter which provides the link to the manufacturing network. This apparatus can be used in several ways: as a source of energy to buffer demand on the network, as a power and therefore a speed regulator and also as a pulse source or a hyposynchronous frequency filter. The feasibility of such an apparatus was demonstrated on the 500-kV, 60-Hz network in Tacoma in the United States. The potential for such a system is tremendous and far from having been completely tested. The field of high frequencies is also involved. Alsthom is thus building superconducting focusing devices for Thomson for use in gyrotrons which generate and amplify extremely high frequencies (100 GHz). These devices will be used to heat plasmas in the tokamak.

Additional prototype developments undergoing tests in the military and space fields are equally interesting. The U.S. Army is presently considering cryoalternators for its planes. Their power-to-weight ratio is 10 times higher (0.1 lb per KW) than that of a nuclear reactor's alternator. They could provide the necessary power to operate on-board lasers. Likewise, Japanese observers report that the Soviet Navy is to start testing cryogenic propulsion for their submarines.

In the space field, the Alsthom-Parvex company, of the CGE [General Electric Company] group, has built a prototype of a motor to control movement of on-board telescopes. A motor of the same power using conventional technology would be 10 times larger, and the withstand current, 100 times less!

[Box, p 48]



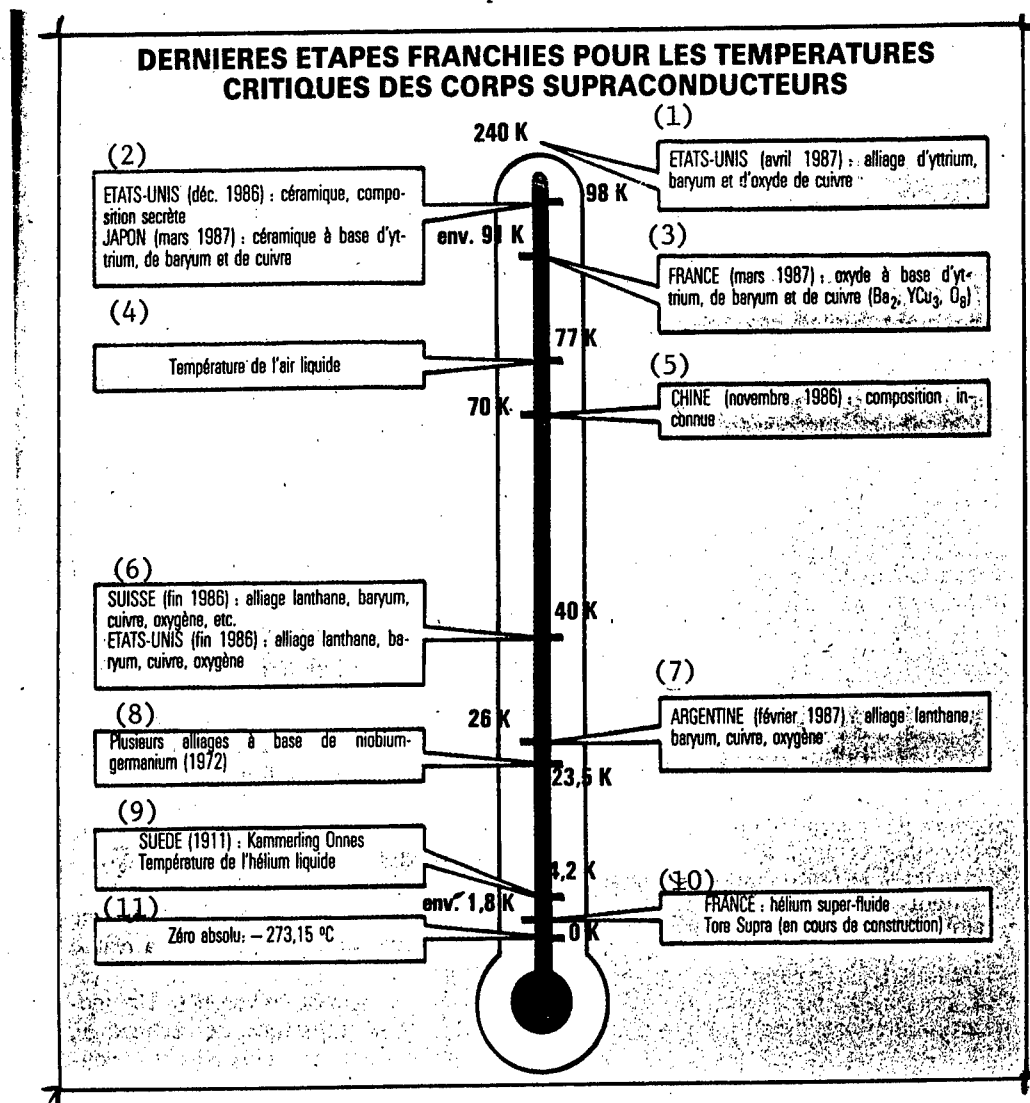
## Tore Supra: Superconductivity for Fusion

On the banks of the Verdon, in the heart of the forest, the CEA [Atomic Energy Commission], in association with Euratom, is building Tore Supra away from indiscreet glances. It will be the first tokamak to use superconducting magnets.

This installation will make it possible to conduct experiments in fusion reactions during which plasma will be heated to more than 200 million degrees for some 30 seconds. To keep the plasma confined, it will use 18 superconductive toriod coils cooled by superfluid helium. This liquid, whose viscosity is extremely low, has the property (among others) of being able to very effectively conduct heat and absorb any local accidental overheating almost instantly. The use of superconducting magnets associated with superfluid helium has many advantages. The first, and by no means the least, is the reduced electrical energy needed for operation: Tore Supra will require  $0.5 \times 10^6$  W to produce  $0.6 \times 10^9$  in magnetic energy, while the Jet, with slightly more than twice the magnetic energy ( $1.45 \times 10^9$  J), consumes 560 times more energy. The second is the possibility of keeping the magnets in continuous operation, thus considerably increasing the confinement periods (barely 0.1 second with current equipment). This system also permits an increase in the toroidal magnetic field and in the density of the current, which means a reduction in the machine's size and, therefore, in its cost.

Future large machines, such as the Next European Torus (NET) which is being built in Munich for Euratom, are also expected to use superconductivity. The International Atomic Energy Agency's INTOR project, which will generate magnetic energy 50 times stronger than Tore Supra, will consume only 10 times more power than the latter. The stakes are tremendous, because fusion will certainly be the 21st century's energy source. It will very likely replace conventional atomic fission reactors where the "basic fuel"--uranium--is rare and expensive. On the other hand, fusion reactors will use deuterium extracted from sea water.

Most Recent Achievements in the Area of Critical Temperatures for Superconductors



Key:

1. United States (April 1987): an yttrium/barium/copper oxide alloy
2. United States (December 1986): ceramic, secret composition  
Japan (March 1987): an yttrium/barium/copper-based ceramic
3. France (March 1987): an yttrium/barium/copper-based oxide ( $Ba_2 YCu_3 O_8$ )
4. Temperature of liquid air
5. China (November 1986): composition unknown
6. Switzerland (late 1986): lanthanum/barium/copper/oxygen/etc. alloy  
United States (late 1986): lanthanum/barium/copper/oxygen alloy
7. Argentina (February 1987): lanthanum/barium/copper/oxygen alloy
8. Several niobium/germanium-based alloys (1972)
9. Sweden (1911): Kammerling Onnes  
Temperature of liquid helium
10. France: superfluid helium  
Tore Supra (under construction)
11. Absolute Zero: -273.15 degrees Celsius

## DORNIER CERAMIC POWDER PROCESS

Friedrichshafen DORNIER POST in English No 1, Jan 87 p 17

[By Dr Rainer Schmidberger]

[Text]

Ceramic materials are applied today for extremely varied technical purposes. Probably best known is the spark plug insulator made of aluminium oxide. Ceramic materials offer many basic advantages over metals such as corrosion and wear resistance, as well as resistance to high temperatures.

That these materials are not yet used more frequently is due to one decisive drawback, namely their brittleness. Under mechanical overload, ceramic materials will break spontaneously, while metals undergo a plastic deformation process before breaking. This undesirable property can be improved substantially when alloys of different ceramic materials are used – as in metallurgy.

The production of ceramic alloys, however, is much more difficult than that of metal alloys, because ceramics cannot be molten like metals. This makes a uniform mixture of the alloy components difficult.

Dornier has developed a procedure for the production of high-quality ceramic alloys in powder form. These ceramic powders then are pressed and sintered (annealing process) with the traditional methods of ceramics technology to obtain compact moulded parts. The Reaction Spray Process (RSV) developed by Dornier is based on the thermal decomposition of solutions in a hot reaction chamber.

A common aqueous solution of all desired powder components is sprayed through a nozzle into a reaction chamber where the water is instantaneously evaporated and where each droplet forms a powder particle. Because of the fast evaporation, the homogeneous distribution of the solution components is transferred nearly completely to the powder particles. These RSV powders, therefore, are characterized by an as yet unequalled homogeneity in the distribution of the individual alloy components. ■

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## DORNIER DEVELOPS MICROGRAVITY MATERIAL MELTING DEVICE

Friedrichshafen DORNIER POST in English No 1, Jan 87 pp 52-54

[Article by Dr Joerg Piller, Dr Richard Knauf, "Levitation Melting Under Microgravity Conditions"]

[Excerpt]

The possibility of containerless processing is one of the most interesting subjects of materials research under microgravity. Under the TEMPUS project a laboratory model is set up to provide the prerequisites for future experiments. Firstly, supercooling effects in metallic melts below the melting temperature shall be investigated. The temperature range will be below 1,300 K, a value that cannot be achieved in a terrestrial laboratory. In the development, special attention will be given to minimal disturbances in the melt samples caused by positioning and contamination from the process atmosphere. The project will profit a lot from experience gained by DFVLR's Space Simulation Institute in Cologne-Porz, collaborators of which have implemented their own accompanying program on the ground for many years and have been awarded the contract for coil development and submitted appropriate proposals for microgravity experiments. Besides, there is strong interest in the industrial sector. Dornier succeeded in ensuring the cooperation of the following companies as subcontractors: Kayser Threde, Munich; Battelle Institute, Frankfurt; Linn Elektronik, Eschenfelden; Profi Engineering, Darmstadt; Heimann, Wiesbaden.

**Scientific and Technical Objectives**

Extraordinary properties in modern materials often can only be implemented when

thermodynamic and kinetic laws influencing the solidification into unbalanced states are known. The desired metastable phases, however, often can only be obtained by fast cooling to get a supercooled melt before solidification or glass formation starts.

Container-free processing now offers the possibility of reaching deep supercooling in massive samples of several grammes' weight since an early heterogeneous nucleation is avoided by the absence of wall contact and a reduced oxide film formation. This allows an undisturbed investigation of homogeneous or heterogeneous nucleation processes and conditions for the formation of metastable phases.

A schematic temperature profile, simulated for a copper sample of 10 mm in diameter, shows the expected process cycle. The recalescence peak demonstrates the warming up in the sample by heat of fusion during solidification.

The application spectrum is to be extended considerably at a later date. The concept of the facility may be used to design a high-temperature calorimeter to determine heat capacities, melt heats, and mixture enthalpies at high temperatures for which no suitable crucible materials are available. The production of ultrapure metals by outgassing and the evaporation of contaminants is another example.

## Construction of the Facility

As a first step in the TEMPUS development, a laboratory model is being built. In this stage, the development of critical subsystems shall be terminated as far as possible and the specified performance criteria confirmed.

The central part of the facility is an ultra-high vacuum (UHV) process chamber in standard conflat (CF) technology. This chamber has been designed for a vacuum of better than  $10^{-8}$  mbar. The individual subsystems are flange-connected forming separate modules of the cylindrical chamber. The UHV parts of the vacuum system can be baked out up to  $400^{\circ}\text{C}$ . In a state of reduced gravity, the sample (diam.: 10 mm) will hover in the coil system being positioned in the center of the chamber by the RF field of the positioning generator. The eddy currents generated in the sample by the heating generator's RF field heat the sample. The temperature is measured – also contactless – with a two-colour ratio pyrometer on the cover flange of the vacuum recipient. With the ratio measuring principle, influences of sample emissivity on the pyrometric temperature measurement can be excluded. A CCD video camera is integrated in the beam path of the pyrometer for process monitoring.

The two RF generators operate as free oscillating push-pull oscillators. Heating and positioning coils represent the respective inductivities of the resonant circuit; so the coil-generator system always oscillates with the resonant frequency of the circuit and thus reaches optimum efficiency. Coil geometry and operating frequency of the positioning and heating systems are optimized as to positioning force and heating power, respectively. Due to the high efficiency and the application of semiconductor components, extremely lightweight and compact RF generators could be built.

To attenuate possible sample oscillations and rotations, the RF field generated by the coils is superimposed by a variable, inhomogeneous DC magnetic field working to the principle of the eddy-current brake. To this effect, a configuration of field-generating adjustable permanent

magnets and flux-carrying soft magnets has been designed.

Sample heat dissipation, which is produced under UHV conditions by heat radiation alone, can be improved in the process cooling stage by the introduction of an extremely pure inert gas such as helium. A gas supply system with additional cleaning stage is used to provide process gases with residual contaminations of significantly less than 1 ppm.

An UHV air-lock system was built specifically for the requirements of the lab model; in connection with special UHV transfer and manipulation equipment, it allows to exchange the sample without venting the process chamber.

In the lab model, data collection, process control and process monitoring are ensured by a commercial laboratory computer with a data acquisition system. For future flight application, however, the development of a qualified microprocessor has begun; it will be used in the projected TEXUS mission already.

## Application

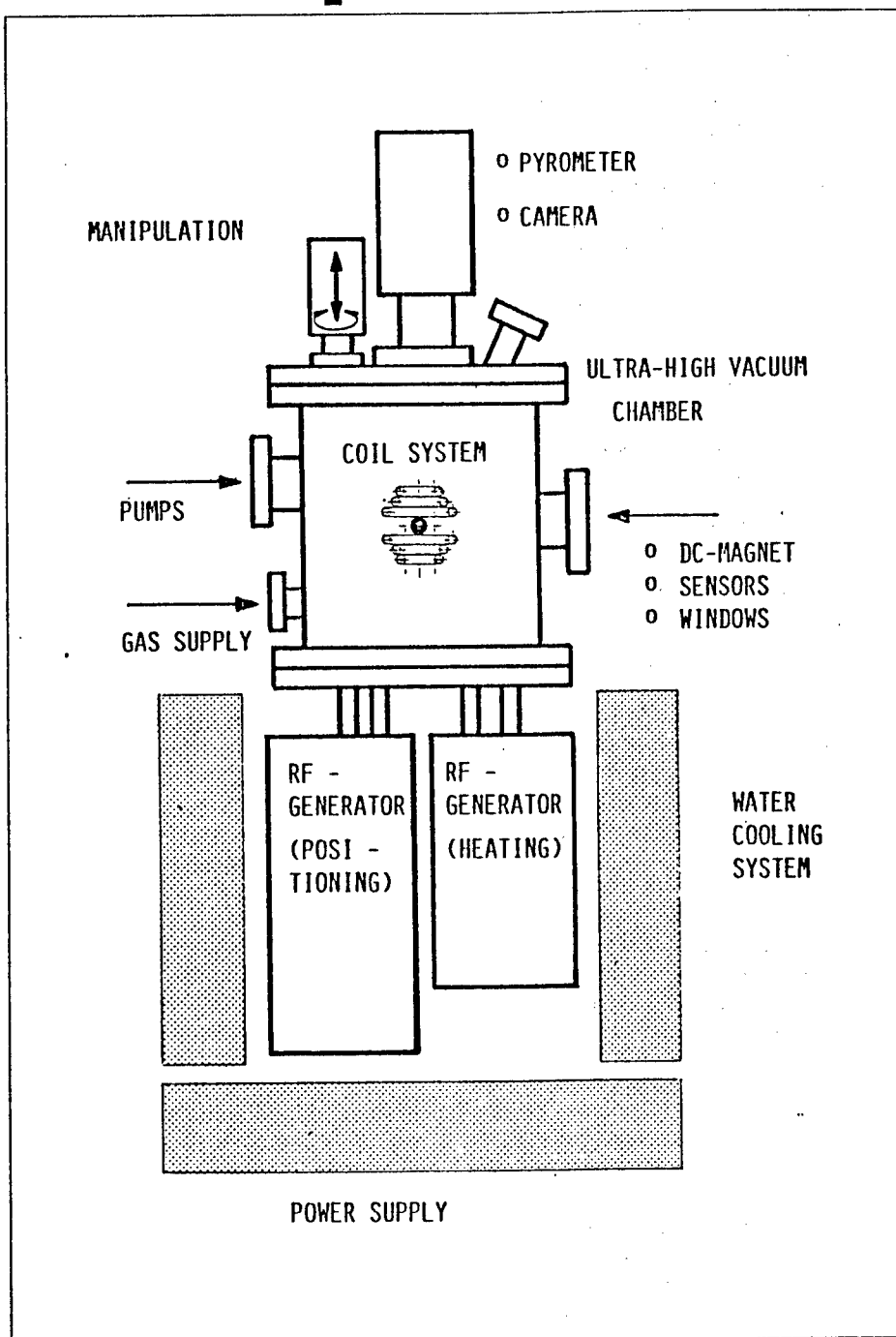
The objective of the TEMPUS project is the development of an experiment facility for a space laboratory on the basis of the laboratory model. The lab model stage is to cover the development of subsystems and components as well as – in a slightly modified configuration – the qualification of the RF positioning and heating system under reduced gravity conditions by parabolic flights in a KC 135 aircraft (available experimenting time: 20 seconds).

The next step in the flight testing of TEMPUS is a TEXUS flight with a two-stage SKYLARK sounding rocket. Micro-g conditions here will prevail for about six minutes – sufficiently long for a complete process cycle, so that scientific results can be expected from this flight as well as facility testing.

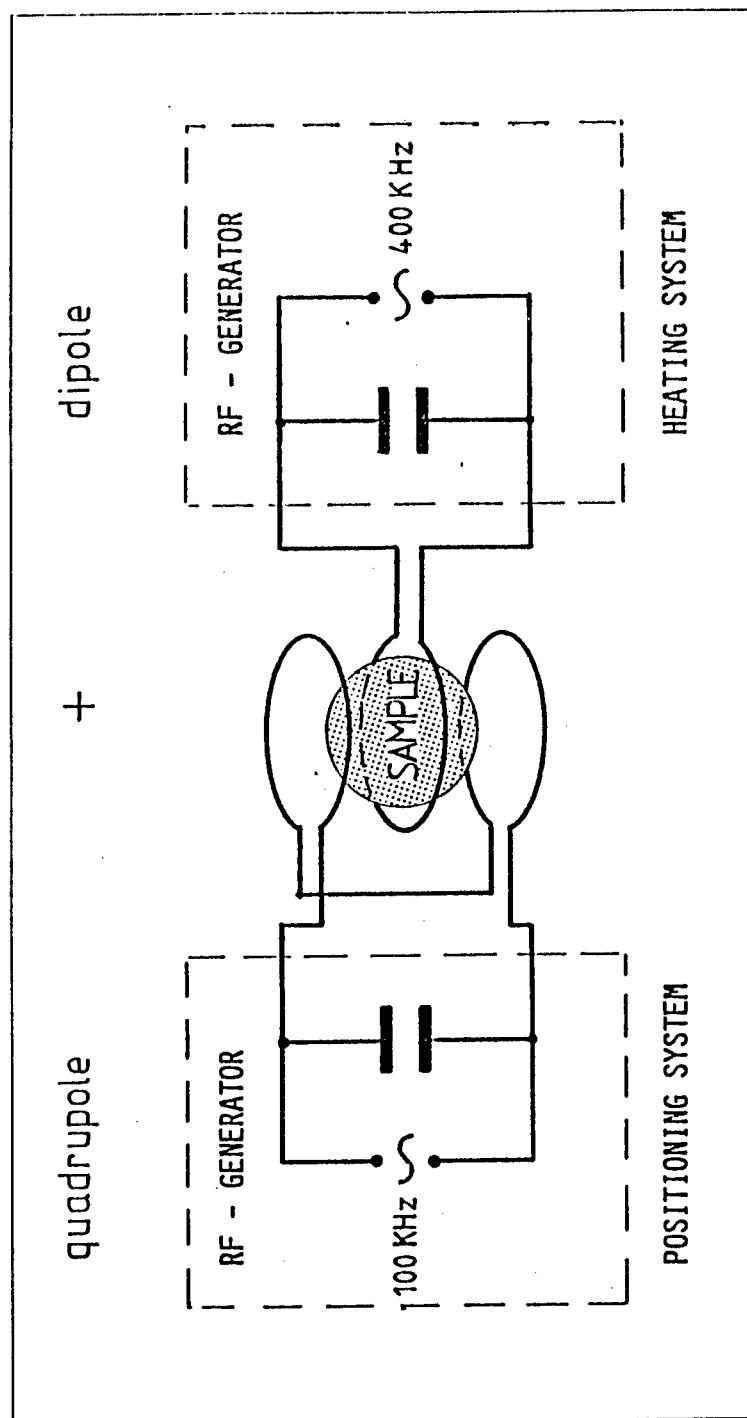
Finally, TEMPUS has been scheduled as a Spacelab payload for the D2-mission (available experimenting time: several days). Here it will be possible to process a complete sample series under different conditions.

The heart of the unit, consisting of the process chamber with RF positioning and

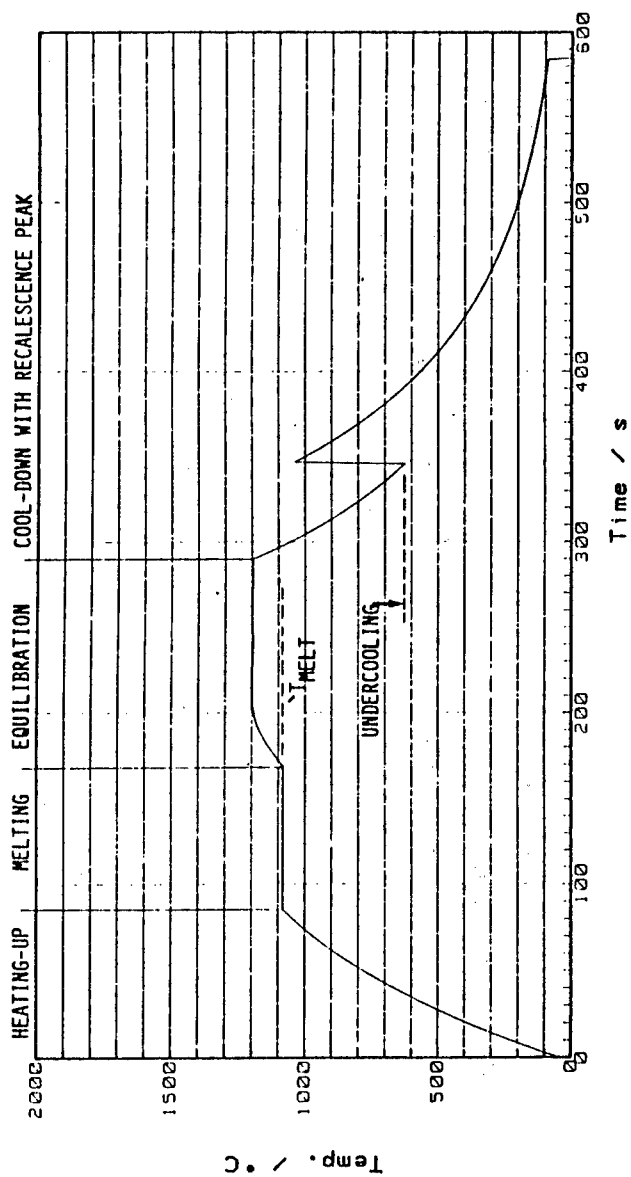
heating system, the temperature measuring system and sample handling equipment, will be used without major changes in all missions. Adaptation to the launch vehicle only concerns the structure, pumping system, energy supply, and accessory components; it is facilitated by the modular construction of the overall system. ■



*Schematic design of the TEMPUS facility*

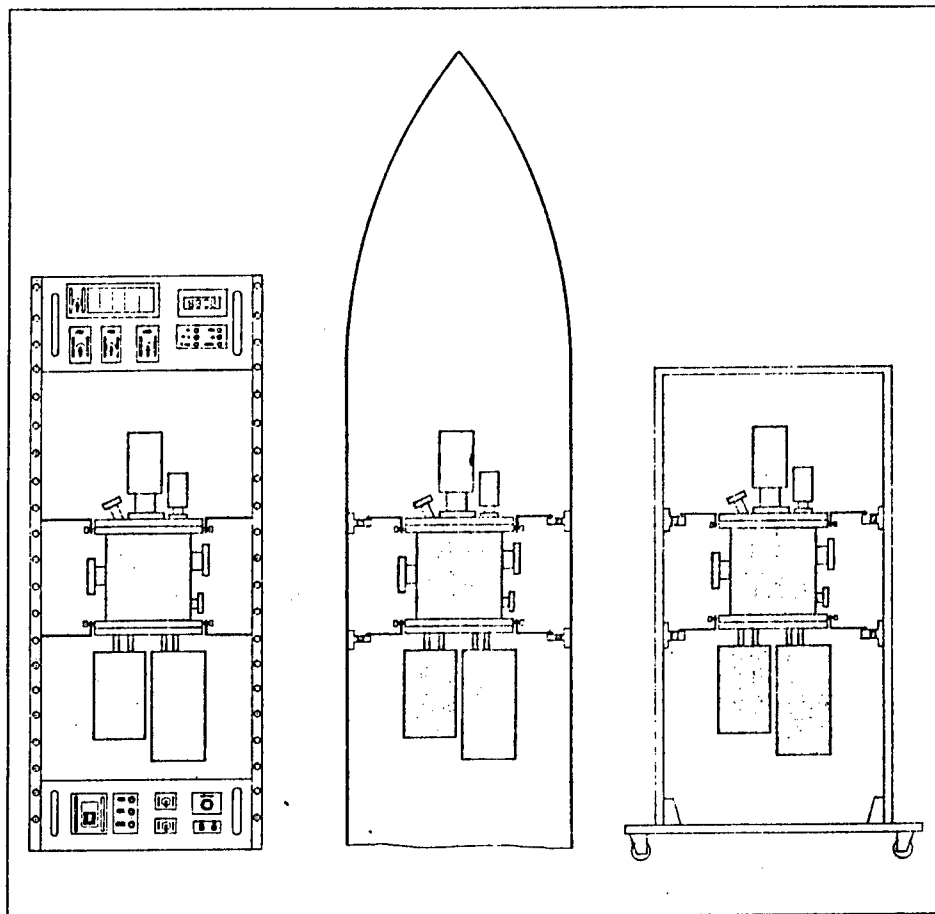


# TEMPUS



Simulated temperature/time profile for a copper sample with presentation of the individual process stages





*The TEMPUS facility as a laboratory model (left), TEXUS payload (center), and rack-integrated for a Spacelab mission (right)*

## THOMSON-CSF OF FRANCE IMPROVES TRAVELING WAVE TUBE TECHNOLOGY

Paris ELECTRONIQUE ACTUALITES in French 15 May 87 pp 1, 20

[Article by G. Cuciuc]

[Text] Having been involved in more than 20 major European and international space initiatives, Thomson-CSF of France's Electronic Tubes Division is continuing to move ahead in the area of space technology. More than 400 types of TWT's (traveling wave tubes) have been delivered by Thomson, and 190 of them are being used on satellites currently in orbit, with a total of more than 2 million hours of flying time. Based on experience, the service life of Thomson TWT's is over 11 years. However, in light of competition from "cable systems," it is becoming evident that the useful life of satellites will have to be doubled--from 10 years currently--hence the necessity for Thomson to continue improving its transmission tubes.

In anticipation of satellite ventures in the 1990's Thomson, as the world's sole producer in the "ground and onboard" tubes market, has already increased the versatility of its TWT's.

## 2 GHz Pass Bands

Thanks to the so-called "brazed-propeller" technology, 30-120W improved-version TWT's have been perfected for use with future generations of medium-sized telecommunications and live-television transmission satellites. Characterized by an efficiency rate which is typically greater than 50 percent--as opposed to 40 percent in older-generation satellites--this was achieved by using a much wider pass band of about 2 GHz providing versatility as well as a three-fold reduction in weight. One must also keep in mind that only a 10 percent increase in efficiency is possible every 10 years. Thomson, in association with the CNET, is currently developing a TWT model with radar applications.

## Flawless CCD's

Besides their TWT activity, Thomson is developing charge-coupled devices (CCD's) for use in space with onboard applications such as: telescope sights, earth observation, astronomy, etc.... Produced on MOS-VLSI processing lines, these units offer some of the most advanced complex memory capabilities

approaching "flawlessness." Thomson is the only producer in Europe of CCD's geared to scientific use. Thomson is currently developing a MIR detector for the SPOT IV program which will be produced in a solid state having 300 components made of In, Ga, and As, with CCD multiplex able to support up to 3,000 elements. A 1024x1024 matrix should be available soon.

#### Space Revenues Near Fr 190 Million

Thomson's space effort--involving 250 employees--represents about 12 percent of the company's Electronic Tube Division's activity, or roughly Fr 190 million.

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CSO: 3698/511

## THOMSON-CSF EQUIPS NEW BRAZILIAN SPACE CENTER AT ALCANTARA

Paris AFP SCIENCES in French 12 Mar 87 p 18

[Article: "Thomson-CSF Provides Brazil With A Satellite-Launcher Test Center"]

[Text] Paris--France will provide Brazil with all the equipment for a satellite-launcher test center. Comprehensive platform factory tests of all the equipment for such a center have just been successfully completed in France in the presence of the client, the Brazilian Secretary of the Army, Thomson-CSF specialists in equipping these centers announced on 11 March.

This system, which will soon be delivered to Brazil, will allow experimentation on and development of satellite or weapons systems launchers. At a cost of several tens of thousands of francs, supplying this center is part of a comprehensive contract signed in 1983 with the Brazilian Aeronautics Ministry for airspace coverage of the entire country known as SISEA (Integrated System for Airspace Surveillance and Control).

Guyan Space Center Director Andre Remondiere revealed upon his return from a trip to Brazil, that this center will be located near the Alcantara launch base in the state of Maranhao.

According to Thomson-CSF, it will be composed of two tracking stations equipped with Atlas and Adour radars, a telemetry station equipped with two antennas, one 10 meters in diameter, as well as the principal processing center which, connected to several different sensors, controls and synchronizes all the firing range equipment. The operations rooms are automated and equipped with control panels on which firing parameters as well as the center's equipment status are displayed using color graphics and alphanumeric representation.

The Atlas tracking radar is one of the most advanced of the current generation. It can be used to track long-range missiles and to determine orbital parameters of satellites. By using radar alone, Atlas allows the target to be tracked up to 450 km. If the latter is equipped with a responder, it can be followed up to 5,000 km. The Adour radar complements the action of the Atlas radar for all short and medium-range use, the aforementioned distances being 200 and 2,000 km.

As the primary supplier for test centers in France (test centers in Landes and in the Mediterranean, flight test centers, etc.) and in Guyana (Kourou for Ariane launches), Thomson-CSF has equipped a total of 20 centers (10 with turn-key systems) and supplied 74 tracking radars on five continents.

## FRENCH INTESPACE'S TEST FACILITIES ILLUSTRATED

Toulouse LA LETTRE DU CNES in French 1 Apr 87 pp 11-12

[Unattributed article: "Intespace: Integrated Space Environment Center"]

[Text] The year 1987 is an important stage for Intespace's test program. In May 1987 the company will have the first space environment test center in Europe to allow pretrial integration and testing under one roof.

This program began in 1984 with the opening of the Capres complex and was supplemented in 1985-1986 by the reconditioning and expansion of the space simulator. It will end in mid-1987 with the installation of a vibration testing area containing a preparation site and a set of three 150-kN vibration generators.

This integrated center will bring together under one roof the integration, preparation, and performance of qualification or verification testing of satellites, space vehicles and large launcher elements. The center contains:

- two complete integration zones:
  - two integration halls
  - two control rooms
  - two airlocks
- one 1,100-cubic-meter acoustics chamber
- one apparatus for physical measurement and balancing
- one space simulator equipped with a solar simulator with a 3.8-m diameter
- one modal analysis site of 5.5 by 5.5 m
- one electrodynamic multigenerator vibration system.

The system study for this last item, which consists of three electrodynamic vibration generators, was developed to minimize the time during which the satellite would be idle while going through the tests.

This package contains:

- one 300-kN vibration system along longitudinal axis
- one 150-kN vibration system along a lateral axis
- one control and command console
- one measuring station.

The two vibration systems, permanently installed side by side, enable the changing of the vibration axis to be limited to a single simple movement of the satellite, thus leading to a considerable gain in time.

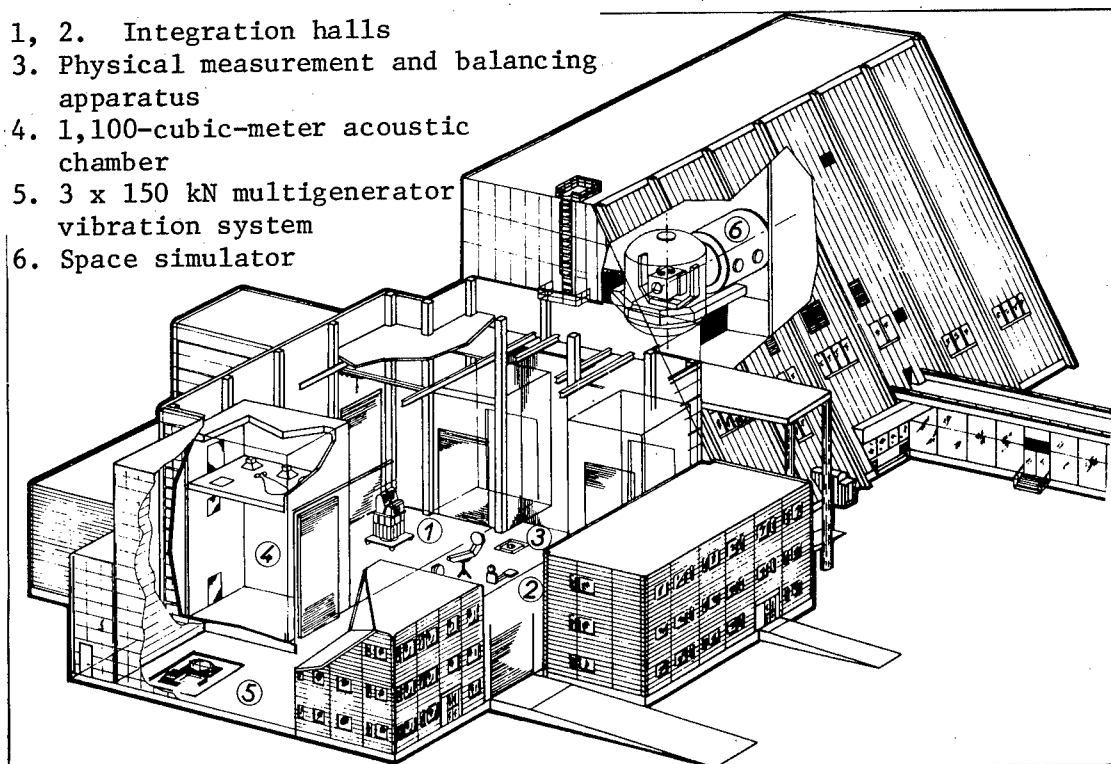
With this integrated center Intespace can meet the technicians' needs: minimum delays for complete qualification or verification testing and limited transportation and handling risks. Moreover, technicians will find integration, preparation and storage halls, a security/quality service, specialized lab or workshop support, as well as technical assistance for analysis of test results and correlation between mathematical models and experiments.

Hence Intespace's export successes: After the space simulation test on the Indian IRS satellite, it was assigned the complete series of environment tests for the Inmarsat 2 and the Italsat satellites, as well as testing for the Tele-X, Iris and Lageos programs.

In order to celebrate its successes and to introduce the center in more detail, Intespace is organizing an open house in May, during which all aspects of its activity will be discussed.

#### Sketch p 11. Schematic of Space Environment Center

- 1, 2. Integration halls
3. Physical measurement and balancing apparatus
4. 1,100-cubic-meter acoustic chamber
5. 3 x 150 kN multigenerator vibration system
6. Space simulator



#### PHOTO CAPTIONS

1. p 11. Integration hall.
2. p 12. Space simulator (Intespace photo).
3. p 12. Acoustic chamber (Intespace photo).
4. p 12. Physical measurement and balancing equipment.

## TWO NEW ARIANE TRACKING STATIONS, KOUROU SECURITY DISCUSSED

Saint-Pierre-et-Miquelon, Kerguelen

Paris AFP SCIENCES in French 23 Apr 87 p 10

[Text] Kourou - The CNES is currently studying the possibility of constructing two tracking and remote control satellite launch stations to be used by the Ariane rocket to launch satellites into polar orbits. One would tentatively be located in the French archipelago Saint-Pierre-et-Miquelon, not far from Terre-Neuve, according to Frederic D'Allest, General Manager for CNES, during a visit by French Prime Minister Jacques Chirac to the Guyana Space Center.

The CNES would like to have the second station, which really needs to be somewhere in the southern hemisphere, located in the Kerguelen archipelago in the southern Indian Ocean, at the latitude of 50 degrees south. Financing for construction might be shared with the French Antarctic Territories (TAAF). According to studies done by the CNES, building the second station at the Kerguelen site would be less costly than using a specially-equipped ship.

Minister of Defense Andre Giraud has recommended that a more detailed study of the matters be done with the French Navy. Locating the tracking stations at Saint-Pierre-et-Miquelon and Kerguelen would make the tracking and follow-up of military satellites such as Helios or observation satellites such as later versions of SPOT much easier.

It is hard to conceive how France can continue to rely on American and Japanese support networks such as in the case of the tracking and putting into orbit of the SPOT observation satellite for military use. The matter has not yet been resolved, but a decision will have to be reached within a year, at the latest, according to the CNES.

## Tighter Security Enforced at Kourou

Paris AFP SCIENCES in French 23 Apr 87 p 10

[Text] Cayenne - Special security measures, "similar to those in place at the foreign space-flight centers," will be instituted at the Guyana Space Center (CSG) for future space shots of the Ariane rocket in Kourou, according to an announcement by French Prime Minister Jacques Chirac on 18 April.

Among other measures, a Breguet-Atlantique will be used to provide aerial surveillance and to detect suspicious ships that might be trying to scramble the electronic signals of European rockets during the climbing phase of flight.

As a matter of fact, "once there were two ships that were transmitting during a launch and we were able to identify them," according to Minister of Defense Andre Giraud, who accompanied Jacques Chirac to Guyana, without giving any dates. "As far as surveillance goes, there are always ships in the waters around Kourou, even if you cannot see them," Mr Giraud added. He also reminded those present that a ground-based electronic countermeasure security system already exists to prevent any interference which could hamper launch operations.

13307/13046

CSO: 3698/530



## FOKKER HEAD ON JOINT ENDEAVORS, COMPANY STRATEGY

Rotterdam NRC HANDELSBLAD in Dutch 16 Jun 87 p 13

[Article by Staffer Pieter Graf: "Swarttouw: Decisions About Fokker Too Often Made Ad Hoc. 'All National Aircraft Industries Are Part of National Strategic Policy'"]

[Text] Paris, 16 June--Political decisions about the aerospace industry should be made as part of a strategic policy defining over the long term what place Fokker is to assume in the Netherlands industrial design. In the Netherlands decisions in this sector are too often made ad hoc.

This is the view of Fokker Chairman F. Swarttouw. In the Fokker booth at Le Bourget, where the 37th airshow is being held, he says, "Here in France every decision is made within the framework of an absolutely clear strategic policy. At a certain point the French decided to stay in the aviation and engine industry, weapons and weapons systems production, and the computer industry. Every year they appropriate tens of billions of francs for that purpose. That is a consistent policy that dates way back to the time of De Gaulle."

The Netherlands, Swarttouw feels, too often makes policy ad hoc. "All national aircraft industries are part of national strategic policy. In the United States research by NASA and the SDI program provides enormous spin-offs, plus most companies--Boeing less so--do a tremendous business in the military sector. And then of course there is Airbus."

Swarttouw expressly states that Fokker "has no grounds for complaint" about its treatment by the Netherlands government. Nonetheless, when he discusses the development credits granted for the Fokker 50 and 100, there is a "but" in his tone. "After all, Fokker is absorbing 40 percent of the cost of those two projects itself. That is a very high percentage and represents a large slice of our financial capacity."

"Fokker does not do badly" in government orders, Swarttouw says, but that is "nothing" in comparison to a country like West Germany, for instance. "Well over half of our sales come from civil aircraft." He cites the system of export permits as a third area of government involvement and in this connection mentions "cooperating to settle matters politically," without, however, indicating whether he considers that cooperation adequate.

## ATRA 90

When asked about the status of the Advanced Transport Regional Airliner 90 study (the ATRA 90 project in which Boeing, Messerschmitt-Bolkow-Blohm (MBB), Fokker, and Indonesia's IPT Nusantara are working together to study the possibility of a 90-100-passenger propfan aircraft), Swarttouw says, "We are still studying it. At present it is very difficult to compete with derivatives of existing aircraft like the McDonnell Douglas DC-9."

The Fokker chairman does not expect the ATRA 90, equipped with the latest technology in engines and guidance systems, to enter the market much before the end of this century. "I see the breakthrough between the middle and end of the 1990's. And I do not know whether there will still be four partners in the ATRA 90 at that time."

At the same time Fokker is talking with MBB about the MPC 75, a study MBB is carrying out with China Aero Technology Import and Export Corporation (CATIC) into the possibility of a propfan aircraft carrying about 80 passengers. MBB wants to hold 35 percent of, and primary responsibility for, this project and to have the final production line located in West Germany. Besides CATIC, MBB is looking for at least one other partner for the MPC 75 project.

The West German aircraft company believes that interest in 80-passenger craft will rise sharply and estimates the market, including the PRC, at about 1,000 planes in 7-8 years. MBB thinks that the MPC 75, which it hopes to bring on the market in 1995, will account for about one third of these. Swarttouw: "Our market analysis shows that aircraft with 50 plus seats and 100-passenger aircraft elicit a great deal of interest but those with a capacity of 70 plus do not. Interest in the segment we covered with the F28 (about 85 seats) is very modest. The Advanced Turbo Prop from British Aerospace (70 seats) is having a very hard time of it."

## Airbus A 330/340

If it is up to Fokker, the company will certainly participate in the A 330/340 project. "If the Netherlands government makes it possible for us to do so (Fokker is talking about roughly 5-percent participation, involving about 400 million guilders), we will be happy to go along," says Swarttouw. He says that with its range of 14,500 km the A 340 will put pressure on the market for the Boeing 747.

"Of course they are different aircraft but they serve the same market segment. I think the A 340--not to mention the Douglas MD-11--will force down the price of the 747, which up to now has been Boeing's milch cow. That will hurt Boeing's profits and therefore its developmental capability."

Swarttouw cites the following example to illustrate how large Boeing's profits have been thanks to its monopoly with the 747: "A 747 costs \$100-130 million and a Fokker 100, say, \$19 million. Of course there is a difference in size but you have to look at the price per seat. Boeing sells the 747 for more than \$250,000 per seat, whereas with the Fokker 100 it comes to \$170,000-180,000 per seat."

Fokker is studying the possibility of one day equipping the Fokker 100 with a propfan engine. At present, however, Swarttouw does not consider this method of propulsion feasible for 100-seaters. Given current fuel costs, he says that the cost of that kind of engine exceeds expected savings on fuel. "With a Fokker 100 you fly, say, between 40 and a maximum of 90 minutes and that is not enough for a propfan to really pay for itself. That is true of the ATRA 90 as well."

Meanwhile the Fokker 100's market segment is getting crowded. British Aerospace is looking at a 2-engine version of its 4-engine BAe 146-300 and Boeing has already announced that it will produce its own 737-500 100-seater. "That 737-500," Swarttouw says, "is actually a poor aircraft. It is too heavy. But there is no doubt that it will be competing with us. There is no sense in denying it. In the past Boeing neglected the lower market segments. But with companies like Piedmont, which operates 45 F 28's, and USAir, which has ordered 100 Fokker 100's, naturally those are numbers that even Boeing is interested in." The French aircraft company Aerospatiale also has its eye on the market for 100-seaters. It is studying the AS-100, which would also have a propfan engine.

#### Replacement Market

In contrast to past years, Fokker has not announced new orders at this airshow. Nonetheless, there are several airlines besides Piedmont that operate large Fokker fleets: Garuda (34 F 28's); Merpati Nusantara Airlines (15 F 27's); and Linjeflyg, Fokker's largest client in Europe, with 20 F 28's. Are there to be no orders from these companies for the Fokker 50 or Fokker 100? Swarttouw: "Of course we are negotiating but I would prefer not to comment before we have signed a contract. It is foolish to speak out of turn."

Fokker recently announced its intention of working on military projects more intensively than in the past. "We want to do that," Swarttouw explains, "in order to spread costs. That is what our Space and Systems Division is for. Moving on from what we learned working on the F-16, we are taking inventory of what we can do in the way of systems integration in aircraft and on the ground. Electronics will be the dominant technology in coming decades. We have in mind such things as space flight, maritime versions of our aircraft, and fire control and defensive systems. We will not supply systems as such, we will not get involved in hardware in this sector."

12593

CSO: 3698/569

## DORNIER STUDY VIEWS EUROPEAN MANNED ORBITAL OPERATIONS

Friedrichshafen DORNIER POST in English No 1, Jan 87 pp 44-47

[Article by Rudi G. Reichert, "Europe Prepares for Manned Orbited Operations"]

## [Excerpt]

Since June 1985 Dornier is engaged in a definition study concerning the potential European needs as well as the equipment and the technologies, required for such future tasks based on the Columbus program and the planned manned reentry and servicing vehicle Hermes.

Dornier as well as British Aerospace have been selected as Prime contractors for the first competitive EVA-studies in Europe based on a tender action by ESA. The following companies and/or institutes form the Dornier-team: Aerospatiale and Dassault (F), Nord Micro (D), Microtechnica (I) and the DFVLR Institute for flight medicine (D). Furthermore the US Companies Grumman Aerospace Corporation and Hamilton Standard act as consultants in the field of manned space operations and life support system/space suit.

In the following a survey on the topic EVA shall be given, based on the past experiences and study results so far available.

**Potential European Needs**

The detailed future Europe mission requirements, especially the individual target dates are most difficult to settle at this time since we are talking about a long-range program (10 to 20 years into the future) which very much depends on budgetary constraints and on results of the present and medium-term space activities in the various disciplines. (Micro

gravity-research, Earth observation, astronomy, etc.) The problem is that the technologies which are expected to be required by the late 1990's and even beyond 2000, where also commercial missions are expected have to be developed now.

Europe can benefit a lot from the relevant experiences gained in the US since 1965 (Gemini, Apollo, Skylab and Shuttle) and/or USSR (Voskhod, Saljut/MIR) even through different needs and/or constraints may exist and the "state of the art" has progressed meanwhile.

The Columbus program includes a participation in the planned US Space Station and the initial use of the US Space Shuttle for cooperative research programs. Eventually, especially in the light of longer term commercial application missions, a Man-Tended Free-Flyer (28.5° inclination) with an own power supply and attitude control system leading to an autonomous manned European Space Station, based on Ariane 5 and Hermes is foreseen. Further elements, such as the Polar Platform and the European Data Relay Satellite shall be mentioned as part of the future European infrastructure.

It is clear that the EVA operations should be kept limited due to cost. Certain tasks can also be performed from the inside of the crew cabine by means of the remote manipulator system, RMS of the vehicle. Also a combination of EVA and RMS op-

eration may be selected in cases, where the distances are limited, thereby avoiding a so called Manned Manoeuvring Unit, MMU for the astronaut.

Another important application for EVA will be inspection and potential repair of the reentry vehicle itself before reentry of the crew as a matter of safety. This requirement may dictate the target date for the availability of certain EVA-equipment, such as airlock, space suit and tools for repairs (e.g. manual closing of the cargo bay doors, potential repairs on retro/AOCS-engines or at thermal protection system and/or rudders).

This would mean that with the target date for Hermes operation by 1996/1997 the relevant EVA equipment should also be operational by this date even though additional mission - specific equipment and more complex operations may be anticipated several years later (phased development approach). This is especially true for operations in polar orbits which will require special protection against the more hostile space (radiation) environment.

#### **EVA-Equipment Accommodation and Testing**

The heart of the EVA equipment to be developed in Europe will be the Space Suit system. (The manned manoeuvring unit will probably not be required on an early date and the EVA-Support equipment (tools) will depend on the individual tasks and will not be treated here). In the light of the weight- and volumeconstraints of Hermes considerable attention must be given to the System Interfaces, i.e. the lay-out of the airlock and the Information system, which shall assure a safe and efficient EVA-operation. Also the ground facilities must be carefully planned since important design criteria can be established by proper simulation and test programs on earth and the space workers will have to be selected and extensively trained in special facilities with respect to their later performance in space. (As a typical example the astronaut Training for the D1 Spacelab Mission of DFVLR in Porz-Wahn shall be mentioned). For EVA the actual performance of the man in the spacesuit with the proper support equip-

ment will have to be tested under quasi zero-g conditions, which are created in underwater (neutral buoyancy) test facilities. In the following typical examples for such equipment/technologies and facility needs will be given.

#### **The Space Suit**

The Space-suit technology to be developed in Europe depends on the actual requirements, which are still to be determined. Especially the suit pressure dictates the technologies, required and also has an influence on the operational capabilities and the efficiency (low pressure suits require considerable pre-breathing times in the airlock before the EVA-operations can be initiated).

The Space-suit has to protect against vacuum, temperatures, radiation and micro meteorites. Also life support functions have to be provided which are breathing, metabolic heat, water and waste management. Furthermore, easy movements and tactility as well as communication information management must be provided. Last, but not the least is safety and a certain degree of economy (longlife, reusability, easy maintenance and universal suit fitting, etc.).

The development of the US and USSR space-suits shows a trend towards higher internal pressures and towards the use of hard suit elements. Probably a hybrid, medium pressure (600 h Pa) suit will a good compromise for Europe, taking into account the storage constraints in the airlock of the Hermes vehicle and the operational requirements.

Usually the life support systems are provided by a back pack, however also umbilicals have been used in early developments, e.g. Skylab. The STS space suit consists of the following subsystems:

- liquid cooling and ventilation garment
- service and cooling umbilical
- EMU electrical harness/battery
- Extra vehicular visor assembly
- helmet
- arm assembly/gloves
- hard upper torso

- lower torso with boots
- primary life support system
- secondary oxygen pack
- contaminant control cartridge
- Communications equipment, and
- insuit drinking bag, etc.

The main components of the primary life support systems are:

- Water tanks for coolant water
- LiOH Module for CO<sub>2</sub> absorption
- Sublimator heat sink
- O<sub>2</sub> tanks
- Ventilator pump and separator unit with controls and displays (various functions)

The secondary life support system holds oxygen-reserves for 30 min. It also takes care of emergency pressurization and cooling. Interesting additional technologies and/or potential requirements are the Info/Communication and the glove systems which may call for advances, depending on the individual mission requirements. The new developments, required can be based on existing relevant experiences from spacelab development as well from advanced equipment required in fighter aircraft developments.

#### **The Manned Manoeuvring Equipment**

For manoeuvring of the space worker several possibilities exist, depending upon the individual task to be performed. The spectrum ranges from hand holds, rails in conjunction with tethers (safety) via mechanical arms with foot-restraints up to the self contained manoeuvring devices, using an own power and attitude control system, such as the US MMU (manned manoeuvring unit). Also integrated attitude control into a space suit has been proposed in the US, however this has not been realized since a modular

concept for the individual functions has been considered more advantageous from the complexity point of view (Kit-type philosophy).

#### **The Airlock**

The design of the airlock depends to a large extent on the selection of the space suit system and its operational (logistics) and safety requirements. On the other hand in the light of weight and volume constraints of Hermes also compromises may have to be made with respect to the selection of the suit-system.

Due to safety space for two Persons have to be provided inside the airlock while final donning and relevant doffing also shall take place there.

#### **Special Test Facilities**

As mentioned earlier special test facilities will be required in order to simulate the operational conditions, to verify the design of the equipment and to properly select and train the European servicing operator. The Neutral Buoyancy Facility for such purposes from NASA is necessary.

Further special test facilities will be:

- man-rated vacuum chambers/hyperbaric chamber and medical center
- six degree of freedom simulators
- Command console with displays for RMS/EVA-training of orbital operations with voice communication from the servicing vehicle (also to train for trouble-shooting).

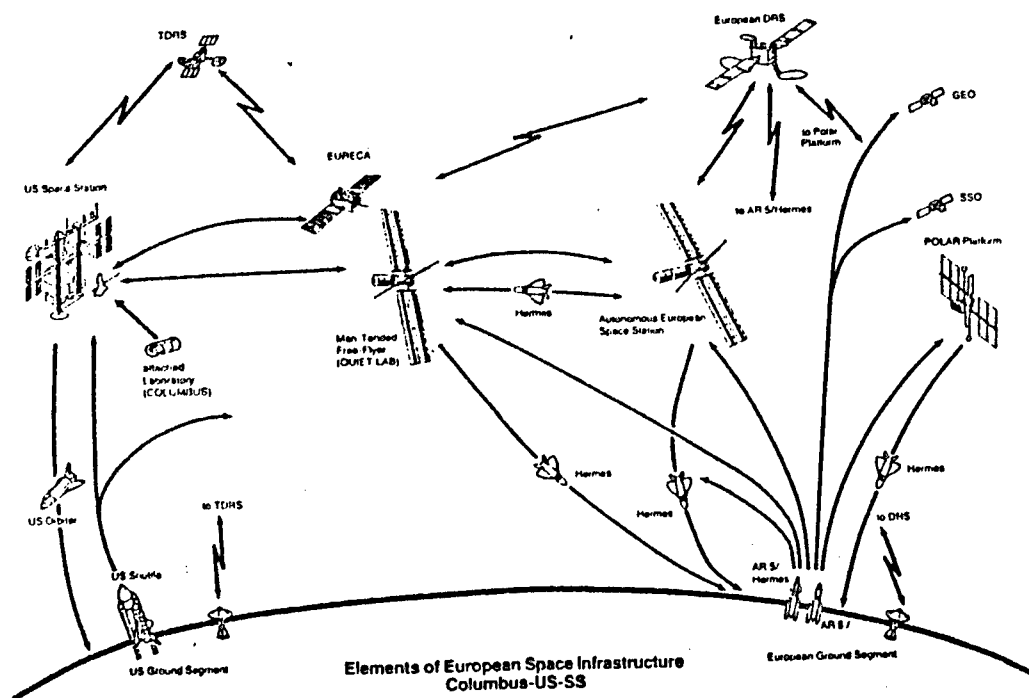
Also zero-g aircraft tests should be performed for last verification of donning/doffing of the suit, egress/ingress of the airlock as well as for a basic training of the astronauts movements under weightlessness condition.

#### **Conclusion**

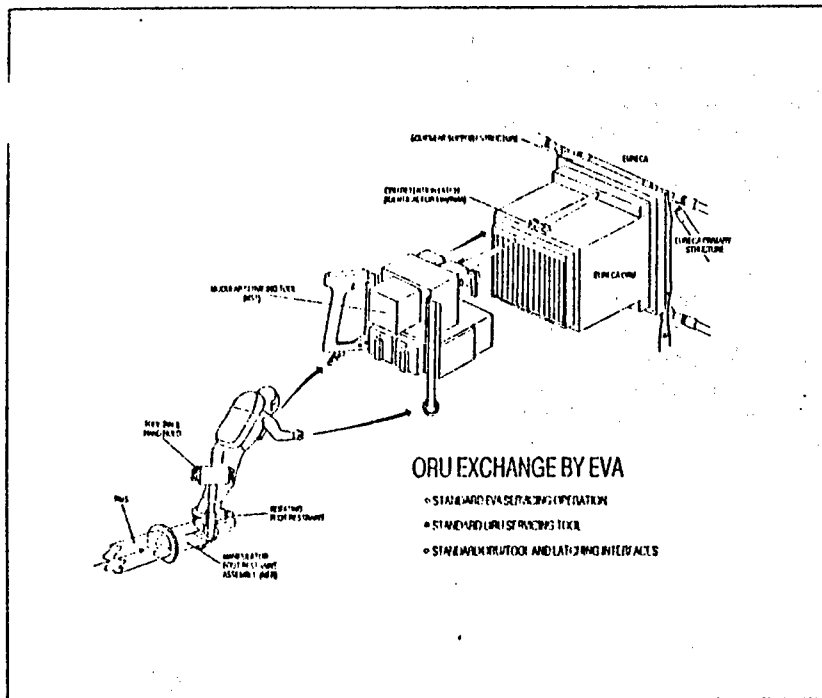
EVA is a challenging subject, now coming-up in Europe in order to reach a certain degree of manned autonomy also

with respect to commercial space activities towards the year 2000. It is the logical consequence of the successful spacelab program and well in-line with the present Columbus and Ariane 5/Hermes space program.

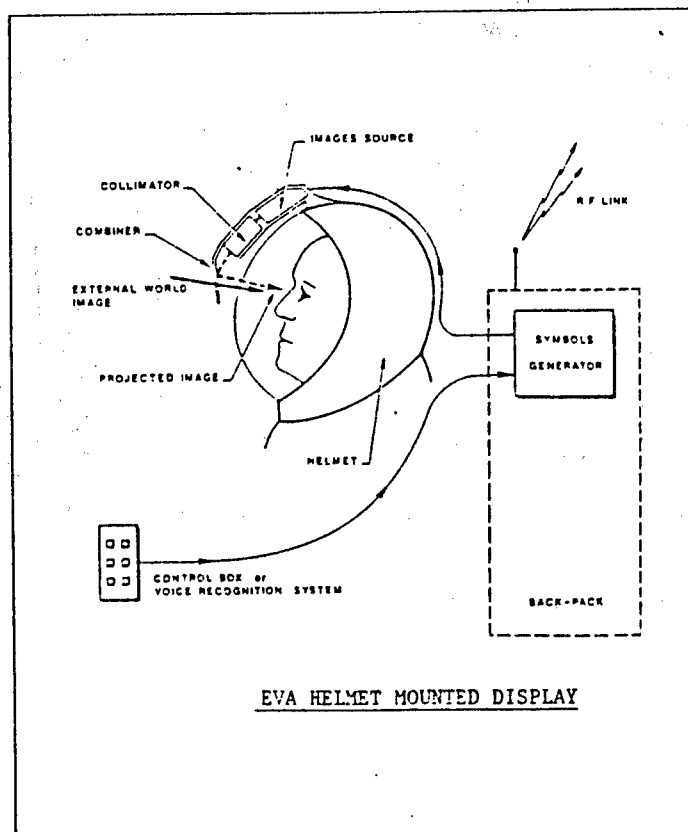
With EVA technologies safety as well as economy of future space programs can be increased and new applications (markets) be opened. ESA plans to award a number of EVA relevant element studies in 1987 and also a strong national (BMFT) interest for such technology preparations exists. ■



*Potential future European and US Space Infrastructure*

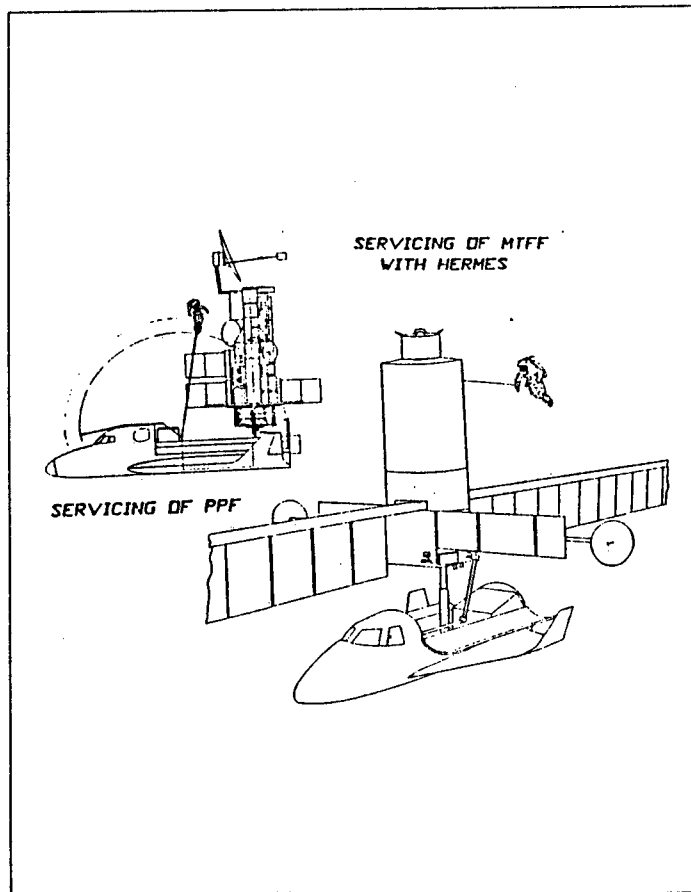


Typical orbital operations (ORU exchange)

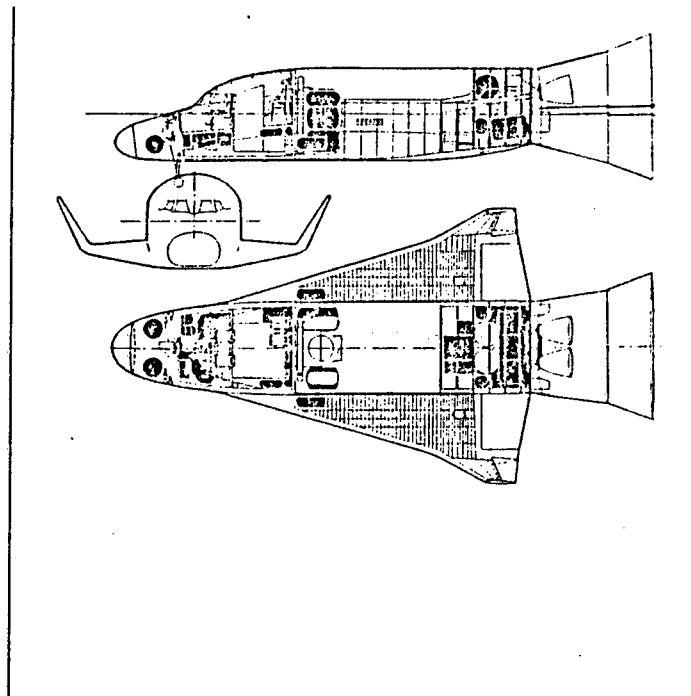


Information system for manned EVA operations

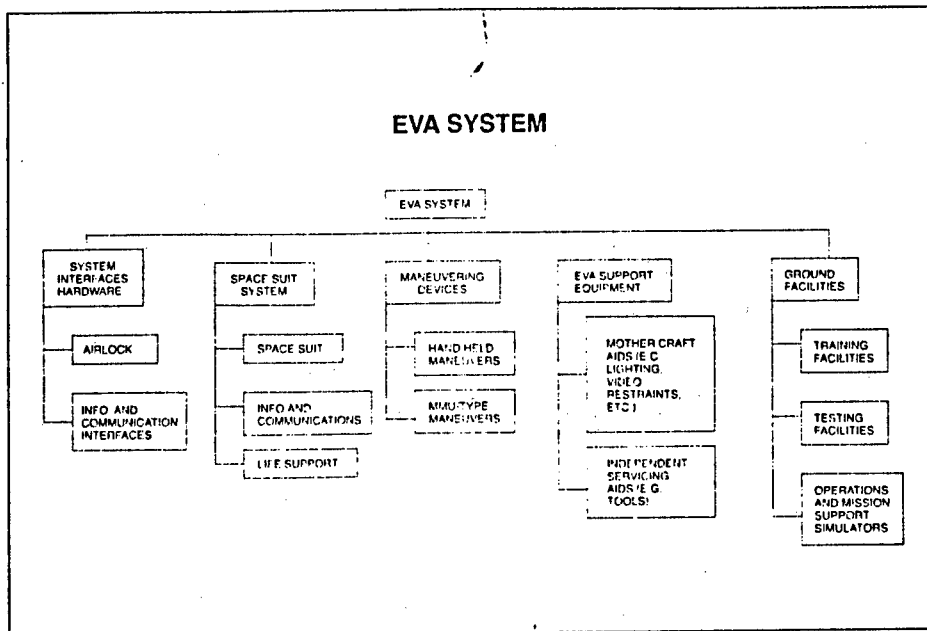




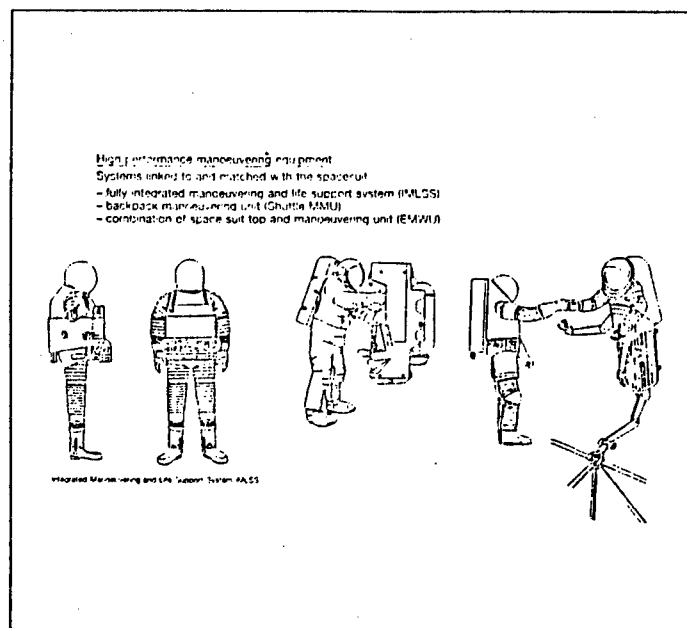
*Servicing operation on MTFF and/or European platform (by Hermes)*



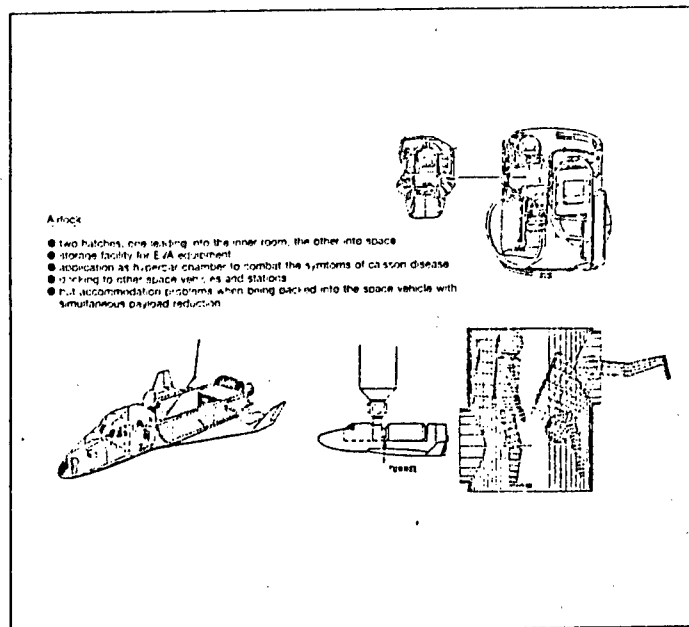
*Hermes - 3 views*



*Survey of EVA system topics*



*Alternatives for manoeuvring systems*



*Airlock and movement studies for optimization of geometry*

## DORNIER PRESENTS 'NEW FUSELAGE TECHNOLOGY' PROGRAM

Friedrichshafen DORNIER POST in English No 2, Feb 87 pp 18-21

[Article by Karl Heinz Dost, "Technological Aspects in Preparing the Development of Regional Airliners"]

[Excerpt] **"New Fuselage Technology" Programme for General Aviation Aircraft**

In 1985 already, Dornier started a "New Fuselage Technology" programme (NRT = Neue Rumpftechnologie) for general aviation aircraft, sponsored by the Federal Ministry for Research and Technology, after preliminary configuration and marketing studies. The medium to long-range objectives of the work were

- the design of optimized aerodynamic fuselages, in particular under the aspect of new construction methods and their evaluations under weight and cost aspects;
- fundamental studies for the application of fibre composite construction methods in the primary structure of pressurized fuselages.

This is meant to extend the use of new technologies to fuselage structures. From the numerous individual studies of the "New Fuselage Technology" programme, two fuselage configurations were derived, C2 and D2, which have been the basis for future work. The two designs have come about on the basis of identical collateral conditions, i.e.

- the same passenger figure
- identical certification conditions
- identical market-related demands

and hence are directly comparable.

The two configurations have been designed for completely different aspects, i.e. in the C2 concept, a compromise was made between the demand for aerodynamic quality, weight, and manufacturing costs. The D2 concept has been designed for maximum aerodynamical quality.

Concept C2 has a two-abreast seat configuration, while D2 with its uncompromising fuselage design for lowest drag has a three-abreast seat configuration and hence has a better stretch potential than C2.

C2 is characterized in particular by a pressurized fuselage little disturbed by wing and landing gear. The wing rests upon the fuselage and is integrated by a large wing/fuselage transition section. The landing gear has been designed in a simplified version similar to that of the DORNIER 228 and with a view to minimum space requirements, but with increased kinematic complexity.

In the D2 concept, the wing and landing gear are integrated into the pressurized fuselage structure.

This had been preceded by a series of theoretical studies in aerodynamics and flight mechanics. For example, optimum-drag slenderness of aircraft fuselages and landing gear bubbles were studied as well as tail designs, in particular with respect to the optimum tail rise angle.

Detailed comparative studies were made of the calculated pressure distribution in the cockpit area of both configurations, the C2 and the D2, using the DORNIER panel method and the boundary limit method. The length of the pressure drop zones provides information on the maximum length of the laminar boundary layer.

The permissible construction tolerances were discussed with the design and production departments and an evaluation was made of additional production costs of this method compared with conventional construction tolerances.

The wing/fuselage transition section was the subject of careful theoretical analysis. Aerodynamic interferences between the wing and the fuselage at the transition point have to be considered. The fuselage causes the wing-induced lift to drop above the fuselage section, while, on the other hand, the wing causes excess speeds at the fuselage. These two effects reduce the aerodynamic quality of the aircraft, and the aim is to improve the situation by providing a good wing/fuselage transition.

Both configurations were evaluated in the Dornier wind tunnel to check out the aerodynamic assumptions.

An analysis of the fuselage drag portions verified by experiment in the wind tunnel was put in relation to the drag of the DORNIER 228-200 fuselage. While friction-induced drag was reduced relatively little in the two NRT fuselages because of the somewhat smaller surfaces and slightly reduced excess speeds, the drag resulting from surface disturbances was reduced to one third of the DORNIER 228-200 value, while the drag caused by structures was cut by a factor of 0.4. The form drag of the C2 fuselage is 51 per cent, that of the D2 fuselage 36 per cent, of that of the DORNIER 228 fuselage.

When the fuselage is seen in isolation, the D2 concept is better by  $\Delta C_w = 0.0019$  than the C2 concept. A comparison of the total C2 and D2 configurations reduces the drag coefficient to  $\Delta C_w = 0.0016$ . The reason is the greater tail unit of the D2 concept resulting in a shorter tail unit lever arm force than in the C2. When the

weights of the two configurations are compared, the structural mass of the D2 concept is higher than that of the C2 concept, which also means an increase in production costs.

### Use of Fibre Composites

The second main feature of the NRT programme was to work out the bases for the use of fibre composite materials in the primary structure of pressurized fuselages.

To start with, different fibre/resin systems on epoxy basis were studied and evaluated for their use in pressurized fuselages.

Likewise, monolithic designs made of CFP-UD material with different stringer shapes and hybrid layers (CFP, SFP, GFP) were studied theoretically and by experiment for their static efficiency under pressure and transverse loads.

Additional emphasis was put on the further development of a cost-effective production method for shells reinforced in situ by stringers. Of particular importance is the production of a test pipe consisting of three CFP shells which has been used for dynamic inside pressure tests. In this production method, the skin with stringer from a CFP mould is cured in the autoclave in one go. The pressure pad is an airpad mat which covers the entire shell and centres the stringers. The CFP frames are fixed with rivets.

This construction is compared with a corresponding segment made in conventional metal construction. The specimens are two shells undisturbed by openings and joints, which have been designed for identical loads. The weight bonus is 26.3 per cent for the CFP version.

It has to be mentioned that the design of the fuselage shell, the geometry of which corresponds to the C2 configuration, had been optimized for cost aspects. Therefore, a pure CFP-UD structure with plate stringers had been selected, which had proved to be an optimum solution because of symmetry conditions in the skin layer structure, skin/stringer design, and fixed collateral conditions, such as fixed stringer and frame positions, and because of the interior pressure load which was a basis for the shell dimensioning.

For cost comparisons, a fuselage consisting of 15 of these shells, including the cost of extra layers in the window and joint areas, was calculated.

The first results led to unacceptably high costs, which could not even be compensated initially by a cost/benefit analysis, i.e. a calculation of direct operating costs (DOC) in which the weight saving was considered.

Measures for material cost reduction, optimization of production processes, and a reduction of the quality assurance outlay then led to decisive cost reductions. If the fuselage tail section/tail unit group is considered, the production costs of a CFP design are higher by approx. 15 per cent.

### Extensive Trade-off Studies

With respect to the importance of new technologies in the development preparation of a small airliner, extensive configuration studies of the trade-offs between aerodynamics and structure are of decisive importance for the overall design.

In this connection, an important sector of the NRT programme concerns the large-area wing/fuselage transition zone, which extends from the cockpit to the tail unit. In addition to the aerodynamic gain of  $\Delta C_w = 0.0002$  compared with a shorter fairing, a better system integration was achieved by housing the air-conditioning system and part of the control linkages under the fairing. The additional weight of the large-area fairing was approx. 36 kg.

In another sector of the study, the question of optimized design of the landing gear fairings was to be solved. A landing gear kinematic system corresponding to that of the DORNIER 228 was compared with one characterized by slanting, space-optimized kinematics as required by the slender landing gear bubble. As the latter version has higher bearing loads, a weight increase in the region of 100 kg was assumed with a gain in drag of only  $\Delta C_w = 0.0003$ .

With this approach, a high aerodynamic quality can be optimally ensured at low weight and production costs, given all other collateral conditions.

Also in fixing the structure and construction methods, advance technological studies have resulted in far-reaching decisions. For example, the high material costs of CFP designs give rise to the question where this material can be used advantageously. Taking the example of the fuselage tail section/tail unit group, a positive trend to identical operating costs at lower weights compared with metal designs can be noted. Therefore, a CFP fuselage fitting frame with integrated rudder unit spar has been produced in a single operation.

The development of a complete CFP fuselage is considered too critical for the time being because of unacceptable high risk, in particular with FAR 25 certification and operating under the special conditions of regional air traffic. The further development of new executive aircraft now in the prototype test phase up to certification will surely have a decisive influence on future aircraft development.

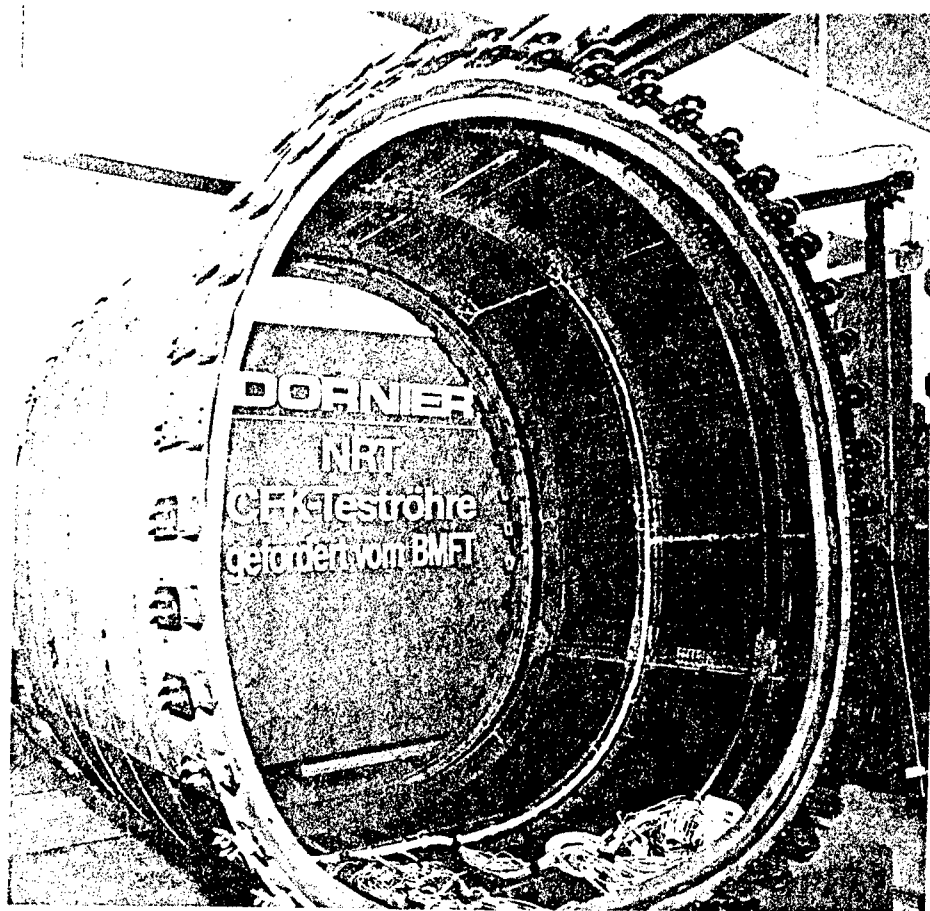
A further field, which is to conclude the application of the new technologies for regional airliners covered here, is the study of acoustical efficiency. The passenger comfort and hence the cabin noise level, play an increasingly important role in this aircraft category. Passengers transferring from major airlines, i.e. from a widebody jet with current cabin noise levels of 78 dBA, to smaller aircraft expect similar noise conditions. Cabin noise levels of this magnitude have been inconceivable until recently because of the associated high weights for noise insulation in regional aircraft. By using new technologies in the fields of synchrophasing, fine tuning of the structural elements, and new noise insulation methods, such cabin noise levels are no longer excluded even when considering economic aspects.

### Long-term Technology Work

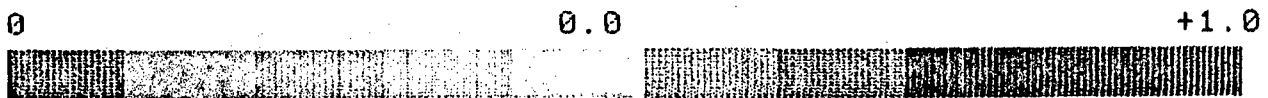
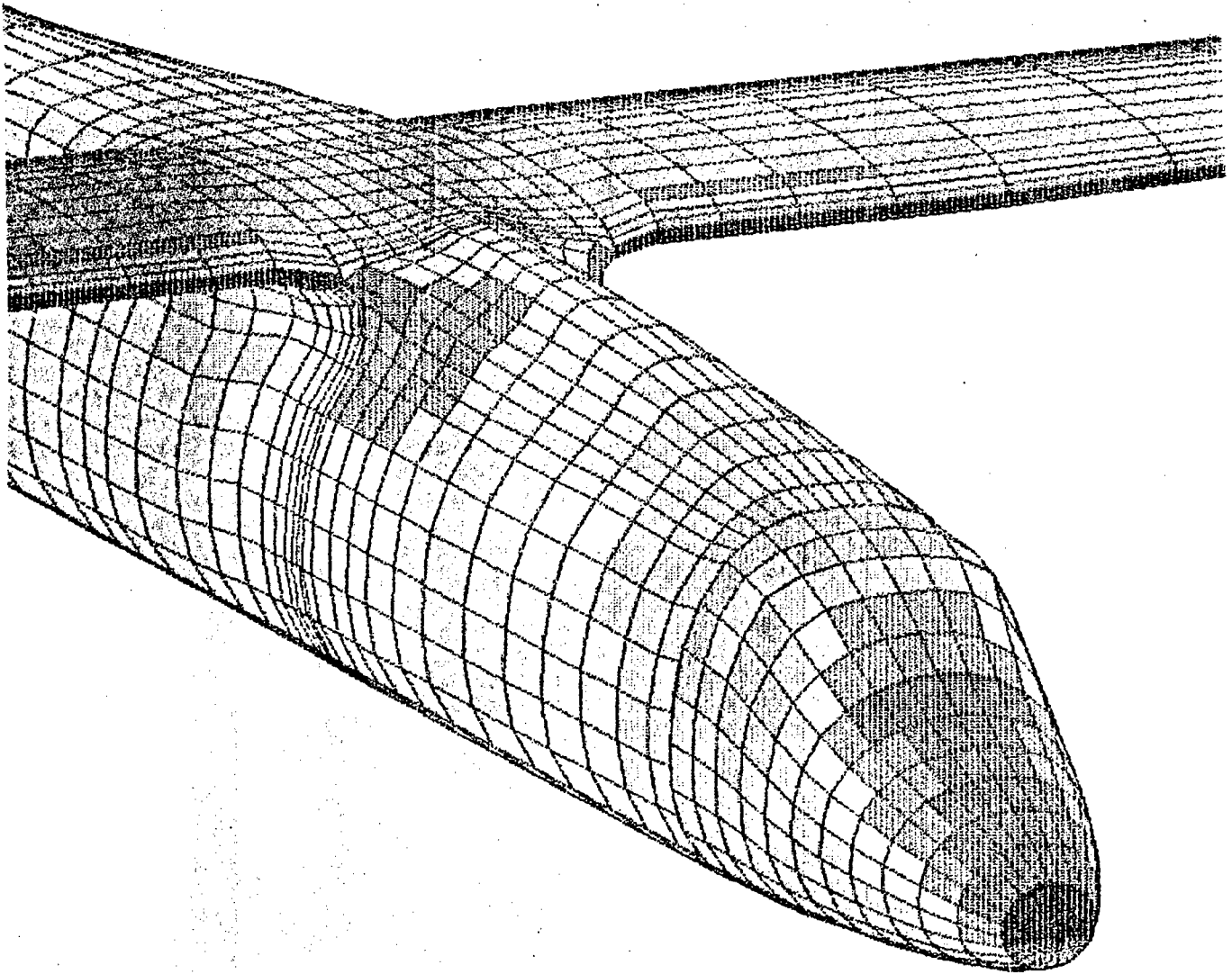
Under its comprehensive activities on the application of advanced technologies in general aviation, Dornier continues its long-term work such as CFP winding technology or methods of unconventional drag reduction. These have already been covered under the technology pro-

gramme introduced here. Other studies refer to novel powerplant configurations and wing designs.

The use of advanced technologies requires sufficient testing in technology programmes in order to reduce the development risk. Without this precondition, considerably longer introduction times will arise for new projects and the competitive advantages will be restricted. Technology testing has to be prepared well ahead and purpose-oriented for the planned aircraft programmes. ■



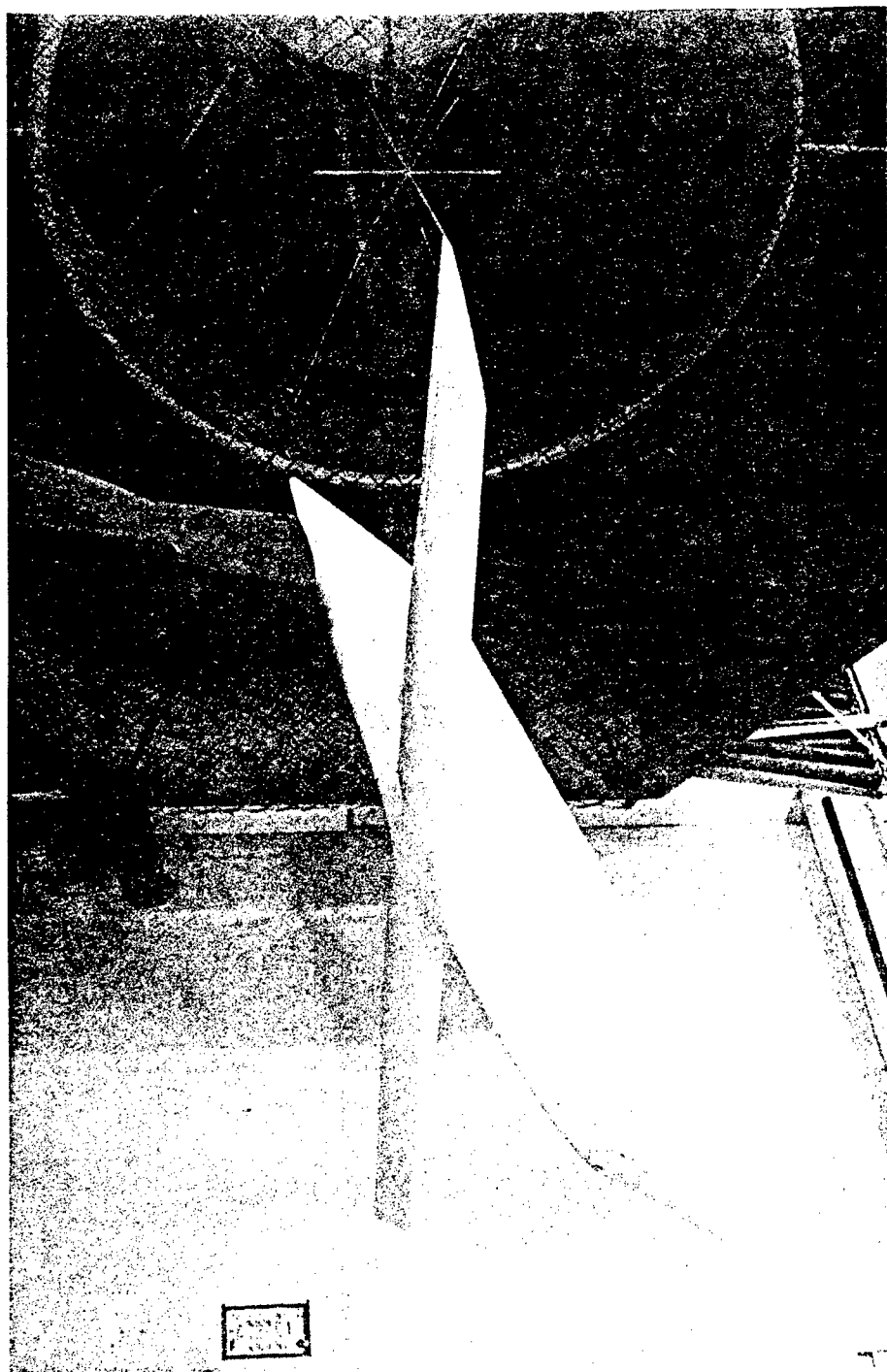
CFRP section of fuselage for pressure tests

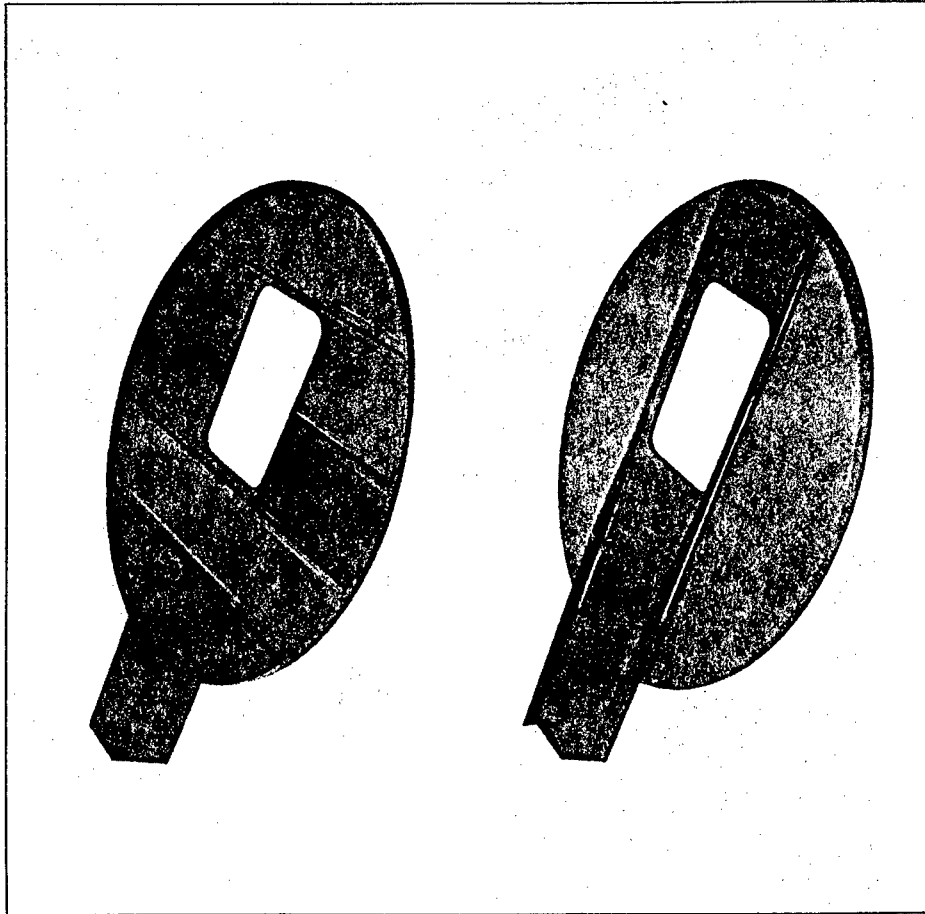


*Calculated pressure distribution on fuselage and wing*



Wind tunnel test model for configuration C2





*CFRP empennage fuselage frame*

## DORNIER VIEWS AERODYNAMIC PROBLEMS OF HYPERSONIC FLIGHT

Friedrichshafen DORNIER POST in English No 2, Feb 87 pp 28-30

[Article by Dr Bernhard Wagner, Dr Herbert Rieger, "Aerothermodynamic Computations for Super-/Hypersonic Flight"]

## [Text]

With flight-velocities increasing the thermodynamic heating-loads upon the flight-vehicle's structures technologically become dominant, thus the heat-transfer from the outer flow to the structure needs exceptional regard. Because the development of numerical methods in aerodynamics made decisive progress in the past decade and the American Space-Shuttle programme revealed the limitations of experimental simulations possible in the laboratory, Dornier also is undertaking intense efforts to provide reliable and efficient numerical methods for the aerodynamic problems in the field of super-/hypersonic flight.

**Aerothermodynamic Problems Set**

The short and medium term problems set for the spaceflight aerodynamics result from the demands on reentry transport-systems like Hermes/Ariane 5. For a longer period the integration of airbreathing propulsion for the launch-phase and the following ascent through the atmosphere will be of great importance (e.g. Sänger- and Hotol-project). Here the development and the integration of the corresponding propulsion-systems and their components (e.g. very large intakes and voluminous engines for hypersonic speeds at very high altitudes) into the total configuration will result in demanding engineering tasks.

In the field of the supersonic aircraft aerodynamics the medium term objective presumably is set by the development of a supersonic transport (SST). Compared with the Concorde it will differ in improved flight-performance and economy at compatible speeds (cruise at Mach = 2.2) due to much improved technology used. The development of civil hypersonic transports (HST) still is far in the future, and possible work concerning air frame and airbreathing engines should go together with corresponding work for space-flight systems.

While a recoverable space-transport follows a characteristic path within narrow limits in both speed and altitude for successful reentry-maneuvers lasting only a few minutes a transport remains in a typical cruise condition for a long period of time. This is why a space-transport encounters an abundance of physical and chemical effects one after another during reentry. At first free molecular flow comes into being, for which the mean free path of the molecules is of the same order as the vehicle's typical dimensions. This is followed by the transitional regime of rarefied gas-flow, which is characterized by the fact that the fluid-particles do not adhere properly but partly slip along surfaces. Finally the vehicle will be back down to the usual continuum flow.

Here it will encounter flight-conditions at which the air affected by the heat-production will undergo nonequilibrium chemical

reactions. Also catalytic interactions will arise. Thermodynamic imperfectness of the air additionally plays a role, which may have influence in form of equilibrium or nonequilibrium conditions. Furthermore the transition from laminar to turbulent flow happens along the flight-path. This will effect the flow considerably and also will cause a sudden increase in the rates of heat-transfer. A hypersonic transport (HST) compared to will travel at speeds, at which only thermodynamic imperfectness may come into bearing, while for a SST only perfect gas properties must be regarded. The heat-load encountered during a reentry must be sustained only for a short period of time. Thus it may be handled by a heat-shield and/or the controlled ablation of surface-coating material. Due to its atmospheric cruise a hypersonic transport (HST) must stand the heat a long period of time. Radical means to stabilize the heat-balance and to limit the heating of the structure are necessary. Presumably the heating problem for this case only can be controlled by using the liquid hydrogen-fuel for surface-cooling before combustion.

#### **State of the Aerodynamic Computation-Methods and First Results**

In hypersonics the aerodynamic evaluation must solve the complete flow-equations including the viscous effects since the viscous zones are much thicker here compared with those in lower speed-regimes and are of importance for the very difficult heat-transfer problems. The complexity of these flows becomes apparent with the example of a circular cone at angle of attack. Beginning at the apex of the cone a shock-envelope develops, while inner cross-flow shocks result in the separation of primary vortices, which induce a pressure-distribution responsible for additional secondary vortices. The computational meshes in the cross-flow plane for two different angles of attack show local mesh-refinements, which were used for the improved analysis of the enveloping shock-front. This was achieved by the successive automatic adaption of the mesh to the result. The good agreement of the calculated shock position with the experimental results also can be seen. The distribution of the static

pressure on the body surface as well as the rates of the heat-transfer at the wall (for fixed wall-temperatures) are shown for a cross-section and reveal good agreement with the experiment.

To show a typical modell of a critical component of a space-transport the two-dimensional flow around a deflected flap at hypersonic speeds was evaluated. Its pressure-distribution along the wall depicts a very good agreement with the experimental findings. The evaluation of the heat-transfer rates shows some deviations, which probably are due to the assumption of perfect gases in the thermodynamic equations of state.

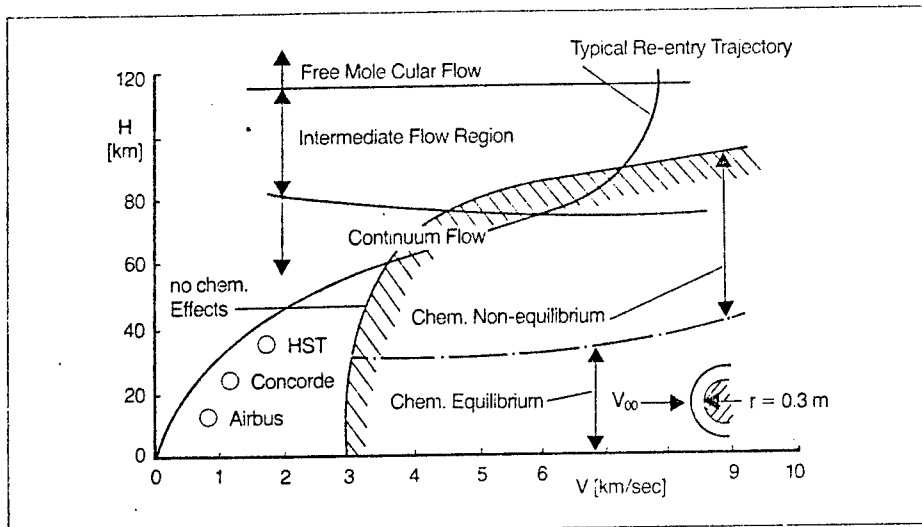
An application of the Dornier evaluation-methods was the Hermes-configuration. For this purpose a suited three-dimensional mesh was wrapped around the configuration; the mesh depicted is situated on the vehicle's surface. A result by the solution of the Euler-equations (non-viscous) is the distribution of the Mach-number in a cross-flow plane. Also first three-dimensional results including viscos effects (solution of the Navier-Stokes equations) were done.

While the evaluation of the flow around the Hermes-configuration demands the solution of the Navier-Stokes-equations due to the high heat-transfer rates occurring at hypersonic speeds and the high angle of attack encountered, configurations dedicated to the flight-regime of a SST usually may deal with nonviscous solutions, which may be supplemented by boundary-layer evaluations for the viscous layer close to the surface. The subsonic cruise condition at low angle of attack shows a favourable pattern of the isobars and characterizes a good wing-design. At higher angles of attack, e.g. during flight manoeuvres, strong vortices spring off the wing's leading-edge as expected, which is characterized by pronounced suction-forces close to the edge.

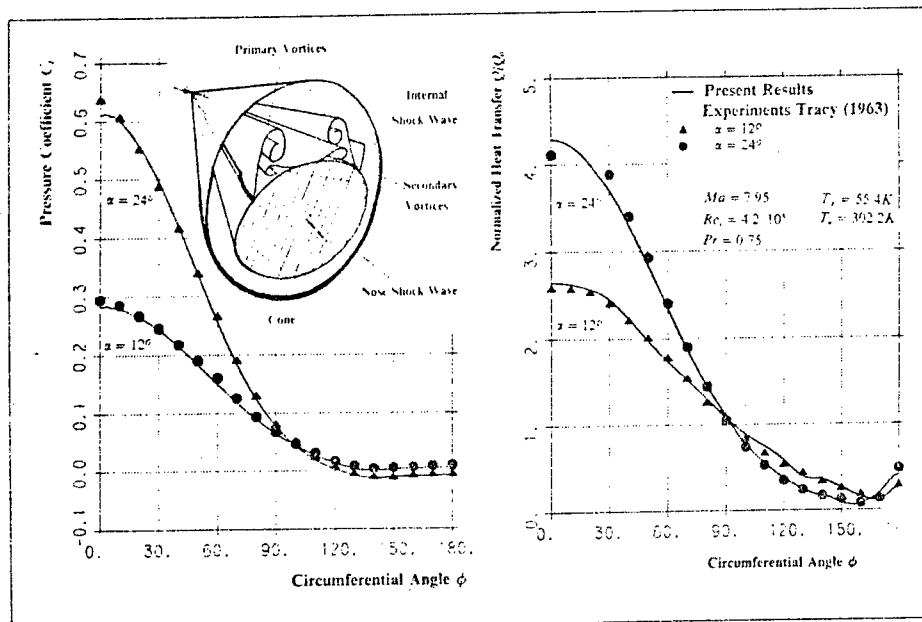
#### **Outlook**

The existing state of the evaluation-methods at Dornier provides a good base for future aerodynamic evaluations of space-transports and super-/hypersonic transport-aircraft. By further improvements and adaptions of the methods many essential problems can be analysed

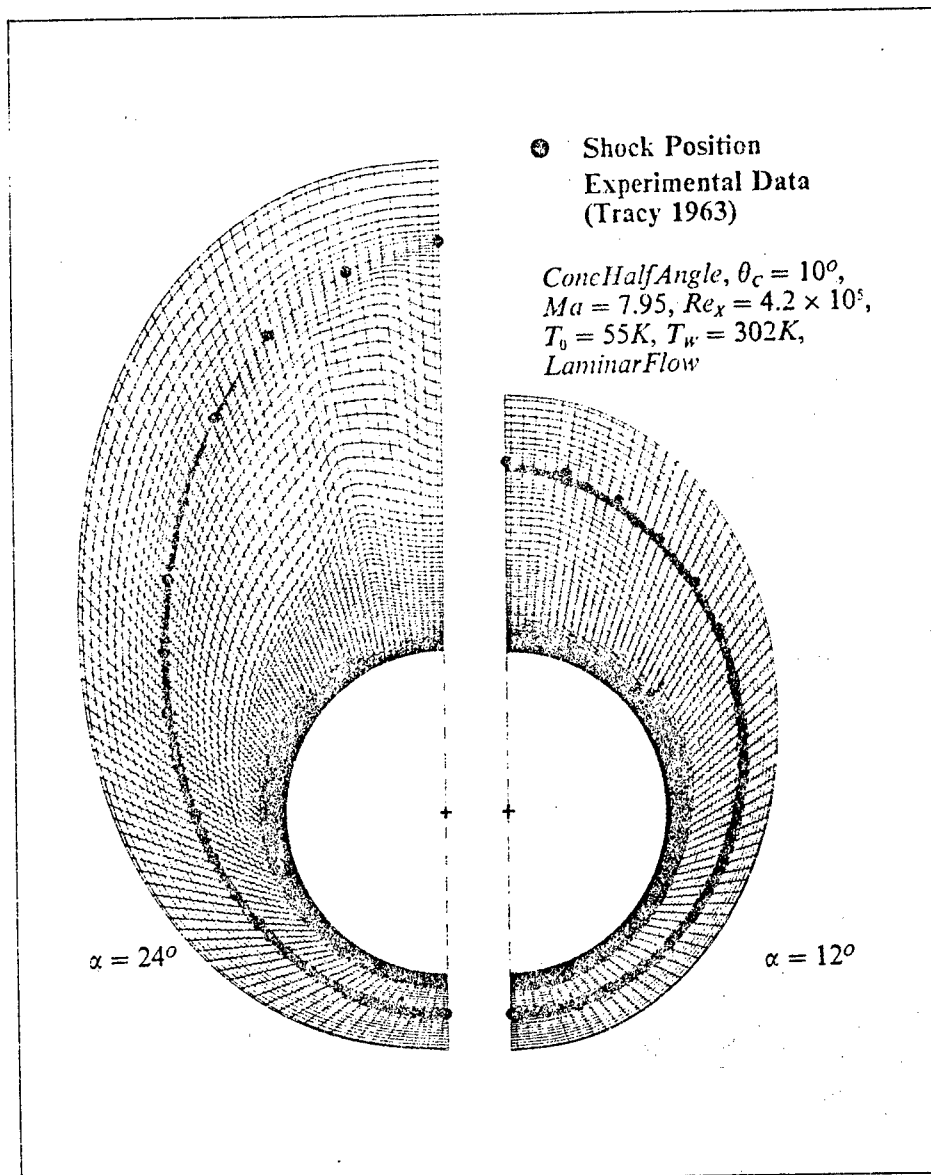
in a short and medium period of time. On the long term however chemical reactions, the transition from laminar to turbulent flow and the lacking knowledge concerning the flow-turbulence at super-/hypersonic speeds remain difficult problems. ■



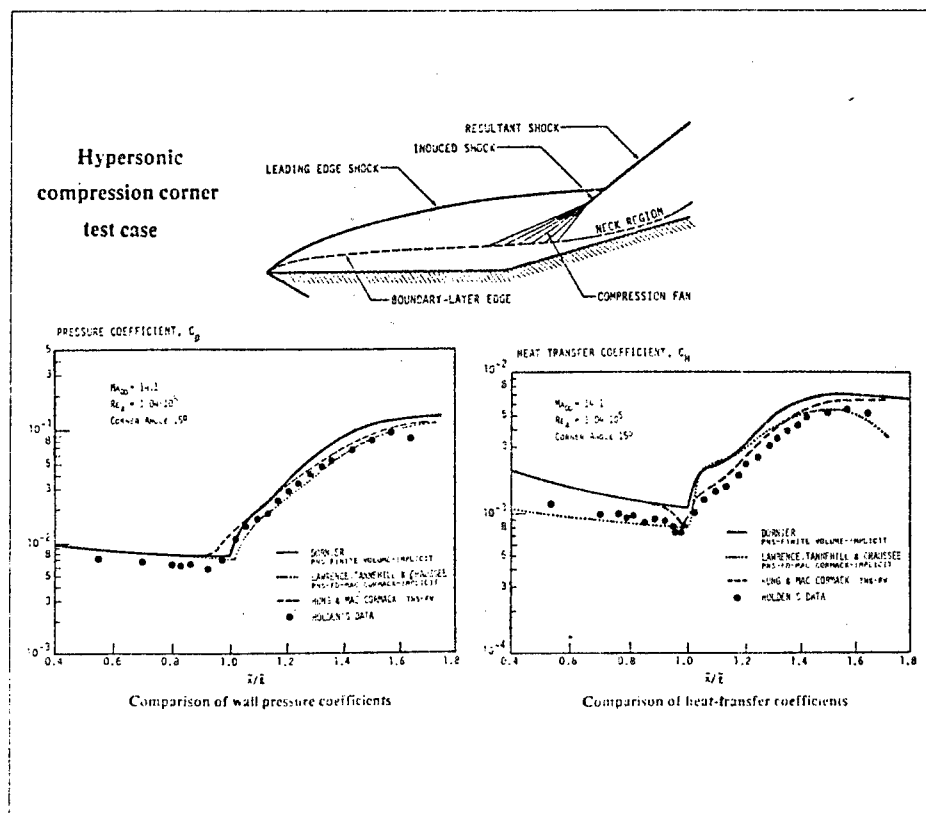
Comparison of typical flight regimes of re-entry spacecraft and transport airplanes



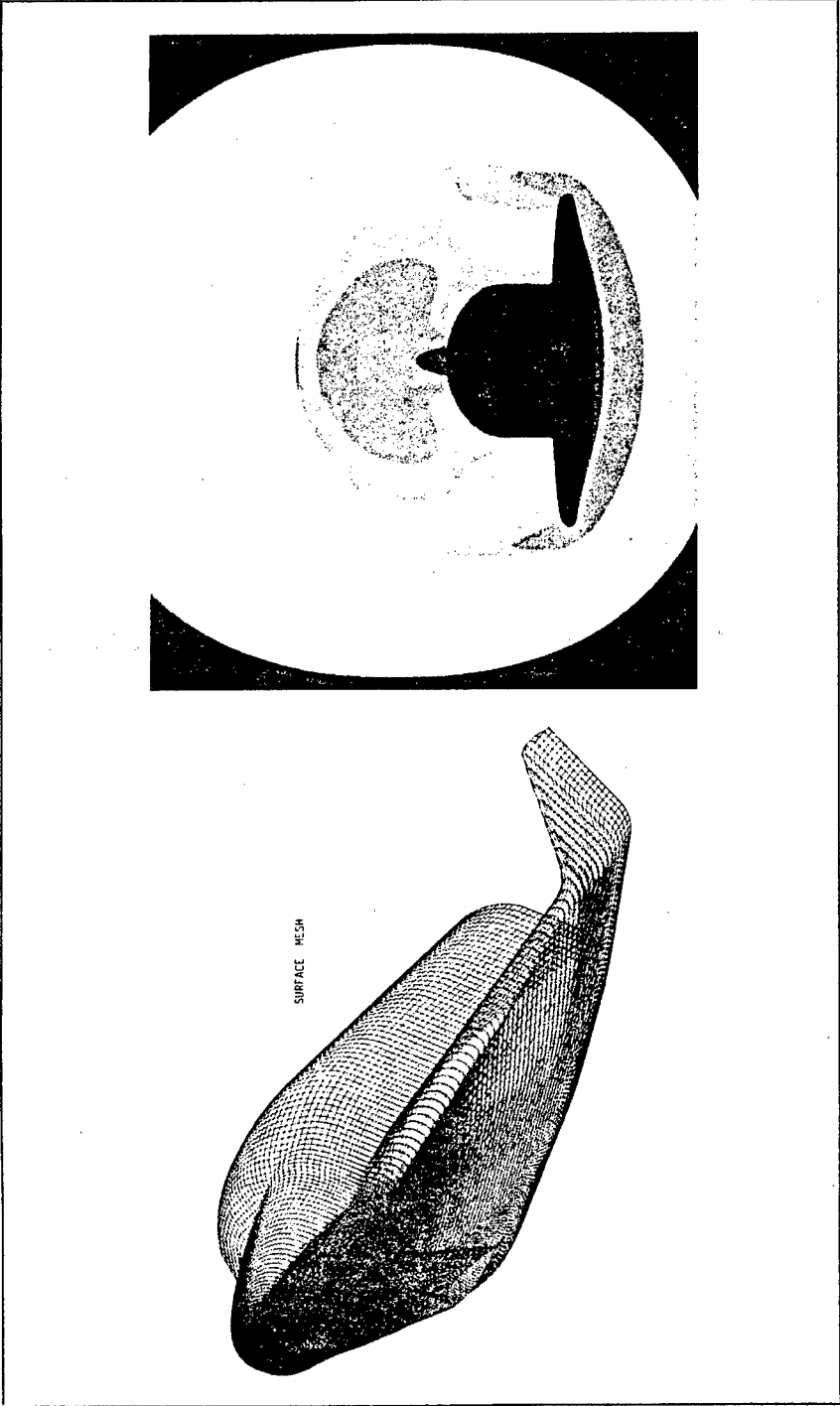
Comparison between calculation and experimental results for an inclined 10 degree half angle cone in hypersonic flow



Computational mesh adapted to the external shock surface in cross planes of the cone flow

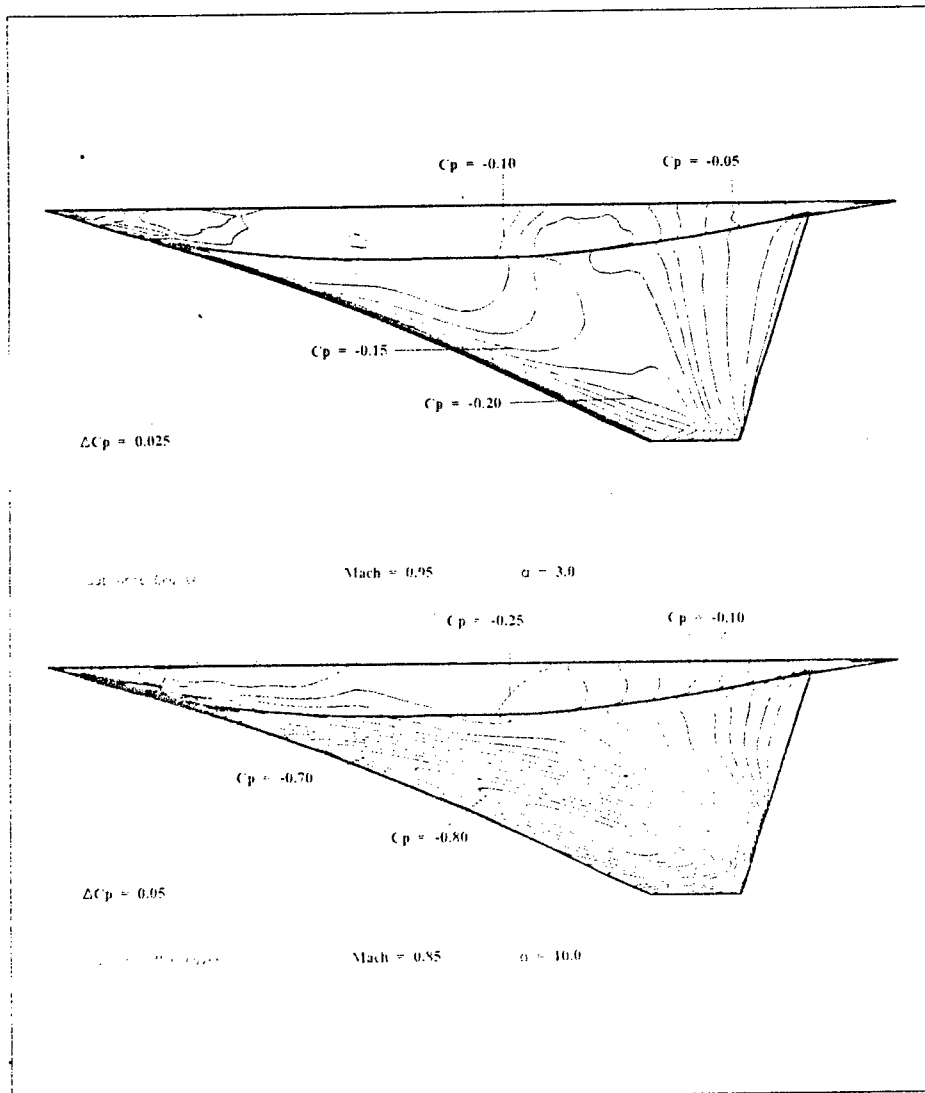


Principal example of a deflected control surface in hypersonic flow



Surface mesh and Mach number distribution in a cross plane of the inviscid hypersonic flow around the Hermes-configuration





Isobars (pressure coefficient  $c_p$ ) on the upper surface of a Supersonic Transport in transonic flow from Euler solutions

# DORNIER ROLE IN EUREKA PROMETHEUS PROJECT OUTLINED

Friedrichshafen DORNIER POST in English No 1, Jan 87 pp 9-10

[Article by Rainer Kurz, "Prometheus--New Technologies for Vehicle- and Traffic Engineering"]

[Text] Every sixth German employee works, directly or indirectly, in the German automobile-industry; 20 per cent of all industrial investments are made with the automobile-industry. Therefore, Prometheus could achieve substantial significance for the German economy.

Through the initiative of the German automobile-industry, all major European automobile-companies have been gathered into an active cooperation. A team with 14 companies was established that are simultaneously competing with each other, and are, therefore, forced to apply the results of this research work as soon as possible in marketable products. All activities, however, should be co-ordinated in such a way, that a Europe-wide introduction of new traffic-technologies and -systems is possible.

## Aims of Prometheus

It is the research aim of Prometheus to create concepts and solutions which will point the way to free-flowing road traffic with reduced impact on the environment and increased economy.

It is intended to create new information, communication and central systems. Use will be made of foreseeable technological advances in the fields of microelectronics, sensor engineering, and telecommunications as well as in the methods and procedures for processing information through the field of artificial intelligence. The safety in traffic should be raised

through complete acquisition of safety-related information in- and outside the automobile and through active assistance systems to help the driver in dangerous situations.

The impact on the environment should be improved through systems, which harmonize the traffic flow and contribute to a better utilization of the existing road-network and by that reduce the need of new traffic-area.

The efficiency should be raised by co-operative traffic management based on on-board and roadside facilities which improve the traffic organisation and traffic flow in individual and public transport as well private traffic.

The economy should be improved through a transition from collective to individual aims and through co-operative communication systems, in order to reduce unnecessary braking and acceleration procedures.

## Project-Structure

The project called Prometheus started on October 1st, 1986 with a one-year definition phase.

Within that phase

- technical possibilities shall be analyzed and rated,
- requirements for future automobile equipment and traffic systems shall be established and
- specifications for research and development tasks shall be defined.

The research project Prometheus is divided in seven sub-projects:

#### **PRO-ART**

Development of principles required for using systems of artificial intelligence in vehicles and road traffic of the future.

#### **PRO-CHIP**

Development of technologies, hardware architectures, and peripherals with emphasis on reliability, efficiency and applicability to vehicles.

#### **PRO-CAR**

Development of computer aided systems in the vehicle to assist and relieve the driver.

#### **PRO-NET**

Development of vehicle-to-vehicle communication networks to enable driving using electrical sight, thus enhancing the perceptive range of the driver beyond his own range of vision.

#### **PRO-ROAD**

Development of communication and information systems between roadside and on-board computers resulting in optimised, decentralised traffic management for private road traffic.

#### **PRO-COM**

Development of the architecture and the general protocols necessary to optimise the communication of data between vehicles, road and environment, and to harmonise the interface components.

#### **PRO-GEN**

Development of scenarios for road traffic of the future suitable for analysing and evaluating the systems developed and possibilities for their implementation.

It is important to state clearly that the focal point of PRO-CAR will not be to produce the vehicle of the future. This is something which will be developed in competition between the companies involved.

### **Form of Cooperation**

In the definition phase the automobile companies cooperate with research institutes and the respective authorities competent for traffic and communication. The inclusion of the supplying industry of car parts and the electronic industry is foreseen for the 2. phase, beginning at the end of 1987. This 2. phase will last about seven years.

DORNIER and AEG are participating in the project as partners of Daimler-Benz. The focus of the Dornier collaboration lies in the sub-project PRO-NET, i.e. the vehicle-to-vehicle communication using "electrical sight". This communication network should operate without or with a very small number of simple, roadside facilities. Electrical sight means that information is received from areas which the driver cannot directly perceive. This includes road junction traffic as well as traffic flowing in the same lane and oncoming traffic on a particular stretch of road will allow the application of a safe, forward-looking driving strategy.

PRO-NET is perhaps the most important element of the Prometheus project with regard to road safety.

Independent research institutes will concentrate on the research work required for the sub-projects PRO-ART, PRO-CHIP, PRO-GEN and PRO-COM. These research tasks are intended to form the basis for orientating the research and development work to be conducted in the sub-projects PRO-CAR and PRO-ROAD. The PRO-ROAD project envisages the creation of roadside communication and information equipment to assist the on-board computer and to enable higher level traffic management functions. DORNIER is also involved in this part of the project.

PRO-CAR is the center of work for the automobile companies themselves.

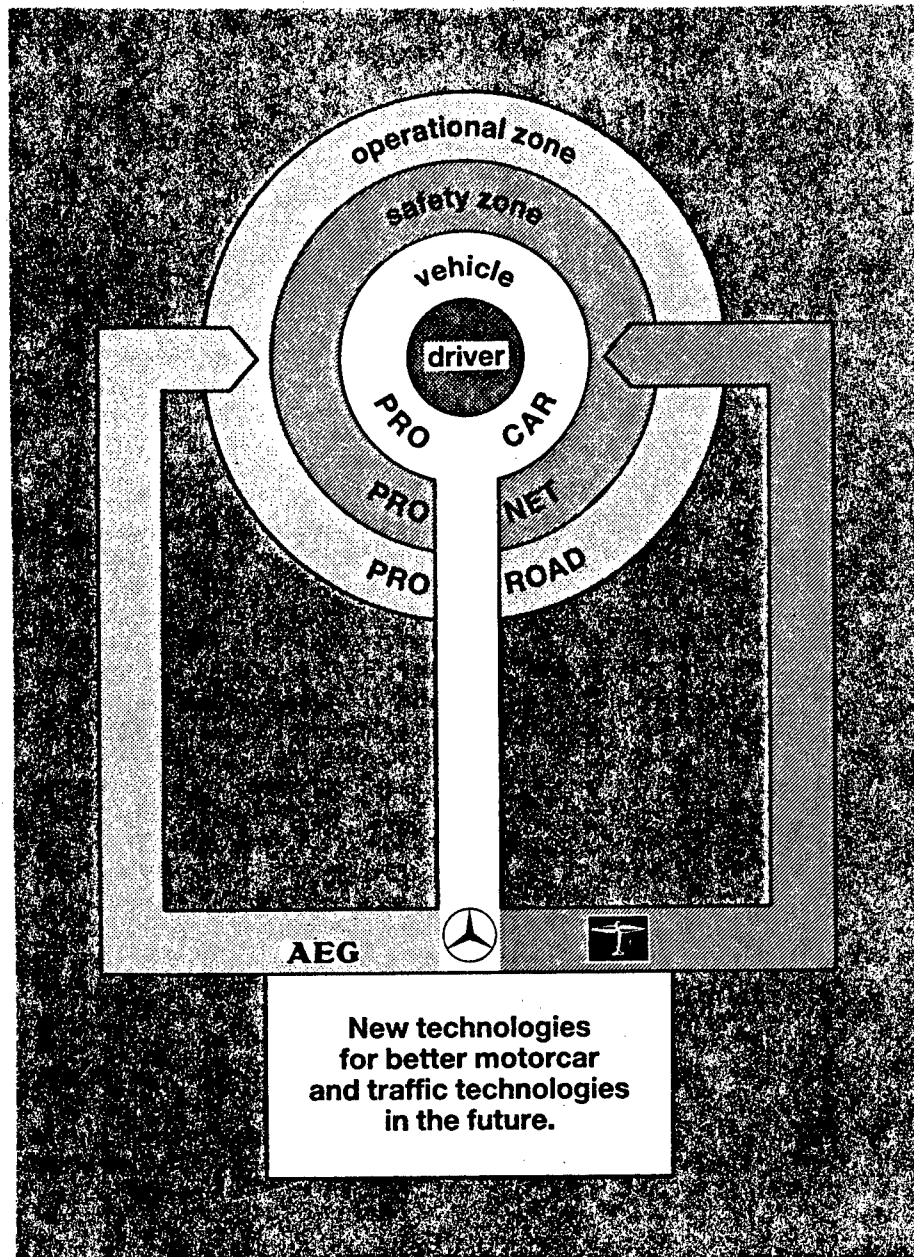
PRO-CAR foresees the development of vehicle prototypes that serve as "technology carriers" to stimulate and promote basic research as well as vehicle- and traffic technologies. These prototypes shall be designed in such a way, that their

concept and technology are ahead of similar systems, which shall determine the vehicle technology of the future.

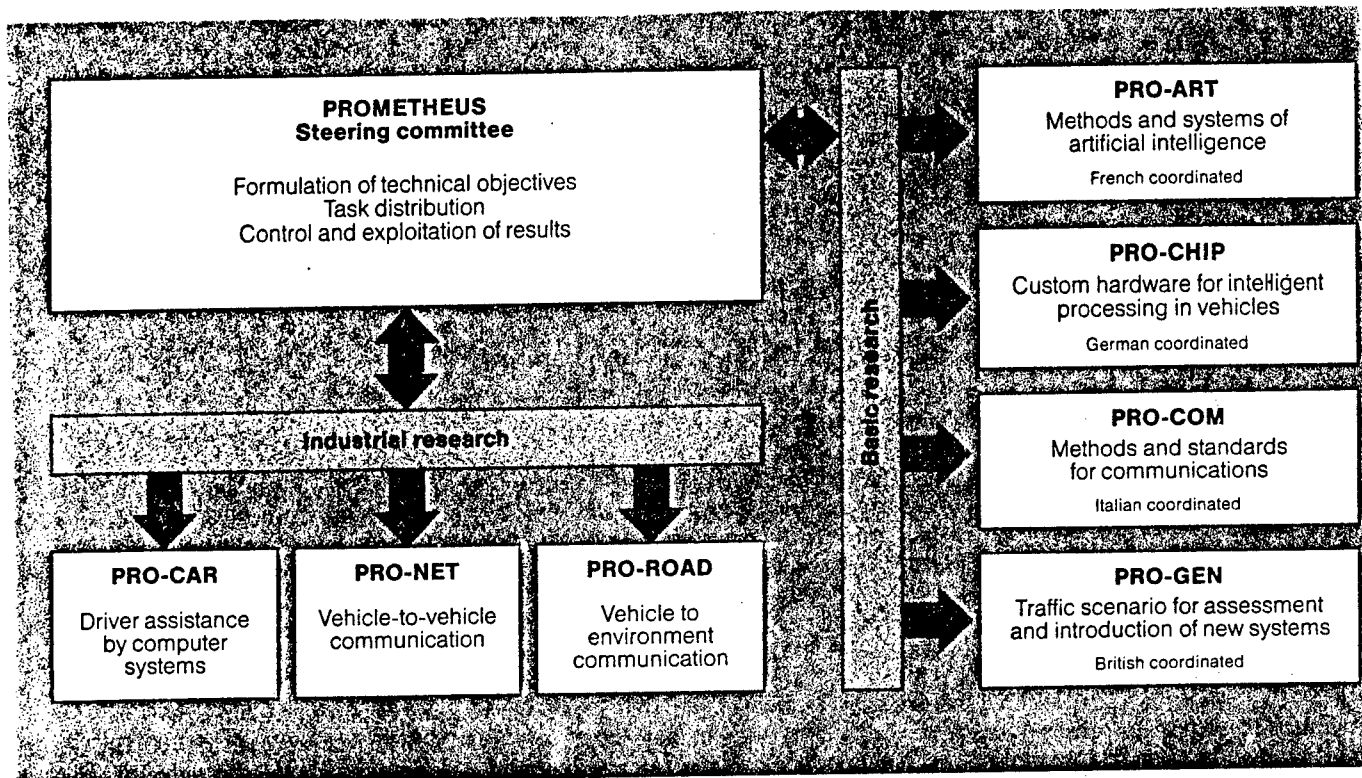
The vehicles themselves should be easily recognizable as research vehicles and should prepare the path for the systems to be developed. It will then be up to each

individual automobile manufacturer to convert the results obtained into standard production models separately and in competition with each other.

DORNIER contributes to PRO-CAR its experience in the fields of sensors and electrical reliability. ■



*Dornier and AEG are participating in the project as partners of Daimler-Benz*



*Prometheus is divided in seven sub-projects*

## EUROPEAN COMMUNITY ROLE IN BIOTECH EXPLAINED

Paris BIOFUTUR in French May 87 pp 52-56

[Article by Jean-Luc Nothias: "1987 in Europe: A Year for Serious Reflection"]

[Text] A series of conferences devoted to European biotechnology strategies was held on 25 March at the BioExpo 87 biotechnology fair. It was organized and conducted by officials from the Commission of the European Communities [CEC]. Approximately 70 persons (manufacturers, scientists from major research organizations, representatives of national administrations, journalists) heard CEC officials explain the broad outline of action already undertaken and plans for the coming years to enable European biotech to fight on equal terms with its American and Japanese competitors.

On this 30th anniversary of the signing of the Treaty of Rome, which gave birth to the European Economic Community (EEC), the CEC officials emphasized that their efforts for harmonization were often thwarted and negated by national policies of the member states.

It is, of course, difficult to reconcile needs as different as those facing the various countries, of farmers and manufacturers, or of consumers and profit margins . . . . But it will be even more difficult to face our competitors' pervasive attacks without concerted action. We must create European policies if we want to be competitive in our own European domestic market, let alone the world markets which are the only ones that really count.

The CEC suggested review of three of these policies: price regulations, regulations governing biotech experimentation and product quality and intellectual property.

The complex technical system of multiple farm prices is described as a "crazy situation" by Paul Gray of the agro-food division of DG III (the CEC has about 20 directorates general [DG]). After a year of new regulations covering nonfood uses of sugar and starch, several problems with the system have come to light. But the CEC is confident that European prices will fall into line with world prices in 1988.

Success can only be fully achieved if other factors limiting the opening of the European market are eliminated.

Among these are statutory regulations governing the production and marketing of biotech products. The CEC has divided responsibility for the various problems posed by biotechnology among its different DG's. An EEC-wide regulatory framework is being prepared. Proposals will be submitted to the EEC Council of Ministers in July. The usual procedure should take about 2 years. The spirit of these proposals is to establish strict regulations for anything that presents a danger and to leave unregulated everything that does not. Biotech products will be subject to the same scrutiny as others, but no more. They should not be unfairly disadvantaged relative to other products or other markets. Moreover, the CEC wants optimal harmonization worldwide. Healthy competition requires common rules, and regulations contribute to that. A single market is planned for 1992 and the CEC seems to be on schedule, but the gestation will seem long.

Another of the fundamental issues being studied on the European level is intellectual property. According to Robert Coleman of the DG III's department of intellectual property and unfair competition, whose report was presented by Mark Cantley, the present situation poses a number of challenges to Europe: patentability per se, disclosure and deposit of microorganisms, obligation to substantiate claims of independent experts, grace periods, plants. Intense preparatory work has been done. Publication of the OECD report, on which the Europeans are basing their work, has caused thinking to change. The new laws will come from the confrontation of scientific facts, existing laws and some speculation. The technical difficulties are not negligible, for all areas must be covered and protected.

Faced with these broad policies which will determine the extent and strength of the European market, the CEC is also concerned with what will determine the direction of European biotech production: an evaluation of priorities in the Community's R&D objectives. Mark Cantley, who directs the DG XII's Consultative Unit for Biotechnology in Europe (CUBE), presented an approach for thinking about the definition of strategic priorities. The elements to be taken into consideration are numerous, ranging from the latest developments in life science, the situation in the United States and Japan and in the member states to an analysis of requirements, strong and weak sectors and world market opportunities. For example, it is essential to consider the development of R&D requirements in EEC member countries: more emphasis on R&D for industrial competitiveness and less on energy research.

As Mark Cantley sees it, thinking about the coming European biotech strategy, which should be established this year, must bring together the largest possible number of players in this field. In this connection he is counting on such groups as the EBCG (European Biotechnology Coordination Group), ECRAB (European Committee on Regulatory Aspects of Biotechnology), EFB (European Federation of Biotechnology) and on scientific, industrial and other types of CEC units such as the biotechnology division and also the BRIC (Biotechnology Regulation Interservice Committee), etc. Extreme importance must be attached to information. The flow of information must be allowed to move from the

producers of products, innovation and ideas to the CEC executives. However, it is equally important to consider the public reaction to biotechnology, recalling current attitudes (reticence or enthusiasm) toward science and its applications.

This is one of the goals of the major scientific research programs funded by the CEC. While they advance knowledge (protein design, biological data processing, etc.) and given rise to or strengthen transnational cooperation--as emphasized by A. Goffeau of the biotechnology division--they also inspire discussion and thereby promote real scientific information for the general public.

Distribution of information on the BAP (Biotechnology Action Program) programs seems to have been good, although insufficient.

Information was good considering the resources available to the CEC, especially because the 1,500 research proposals received resulted in 262 funding contracts (50,000 ECU over 3 years) with 300 "priority" projects on a waiting list for hypothetical funding. Resources are limited: BAP will receive 55 million ECU for the 1985-1989 period. A revised BAP providing additional funding for new projects will be requested. Other future programs are in the planning stage: BRIDGE (Biotechnology Research and Innovation for Growth in Europe), which is even more industrial, and SAID (Stimulation of Agro-Industrial Development). All these programs are being prepared and they provide a beginning trend in which member country experts are actively participating.

Information was insufficient because certain areas were inadequately covered and because some research teams missed out on this funding round.

The CEC hopes to receive as much response as possible to these programs. It still faces some unanswered questions: Will international cooperation be implemented as requested? Is industry really committed to the research projects, or is it just saying so? Moreover, the CEC is trying to create a legal framework for a group that will encourage the commercial application of projects, e.g., European GIE's [economic interest groups] or industrial clubs, etc. It is in this spirit of aggressively encouraging competitiveness that the CEC supports cooperation with manufacturers.

These were the main themes put forward by Dr B. Rami of the EUREKA office. After explaining the objectives and operation of EUREKA and its principle of variable financial support, he showed that although seemingly detached from the other European initiatives, EUREKA was not unaware of them. The programs are coordinated informally. It can even be said that in spirit the EUREKA biotech programs supplement the BEP (Biomolecular Engineering Program) and BAP programs. They are more application-oriented than the R&D process and focus on industrial and commercial operations.

Biotechnology constitutes a new field, with uncommon structures and great dynamism. The policies which are to govern its rapid, sometimes hesitant, or even unforeseen developments are being studied in the CEC's directorates.



These policies must be both solid and flexible. Their design must draw on the expert advice of all biotech professionals. This is the wish of the CEC executives. It is the fundamental condition for their success. Europe is often seen only as having problems of agricultural quotas and a fragmented common market. On 25 March we saw a Europe that is working, searching, questioning, and imagining; a Europe that wants to make optimal use of the tools of biotechnology.

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## BIOELECTRONICS DISCUSSION AT FRENCH BIOEXPO 87

Paris BIOFUTUR in French May 87 pp 44-47

[Article by Sylvia Vaisman: "Bioelectronics, Biosensors, Biochips, Biomemories"]

[Text] Is a convergence of two advanced technologies unavoidable? The barriers encountered at every new enhancement (even greater miniaturization of silicon integrated circuits and the need for an intelligent tool for progress in modern biological research) seem to make the interpenetration of electronics and biotechnology inevitable. Although the idea of using organic molecules as substrates for data processing is already quite old (Footnote 1) (Publication of J. Polonski, 1960), we had to wait for each of these research fields to evolve sufficiently to embrace the other. The first applications linking biotechnology and electronics--biosensors--have already appeared on the market.

Far more than just joining two advanced technologies, today we are witnessing the emergence of a new discipline: molecular electronics, a real interface between biology and electronics. According to international specialists, it would be impossible to build a technological future without such an approach, long described as unreal, but in which laboratory work becomes more concrete every day. Bioelectronics as a whole seems to have undeniably moved beyond the area of pure scientific speculation. BioExpo 87 could not ignore this reality and devoted a full day to bioelectronics.

"The first attempts to develop enzyme sensors for glucose in Japan date back 16 years," (Footnote 2) (Prof Pierre Coulet later pointed out that the concept of enzyme electrodes; developed by Clark and Lyons, dates back 25 years) said Prof I. Karube from the Tokyo Institute of Technology, who had come expressly for the conference. He explained his team's work at length and detailed possible area of application and new generations of biosensors developed in his laboratory: a hormone and cancer-cell immunosensor directly connected to a fluorescence microscope; a field-effect transistor pH-variation sensor no larger than a match, whose detector enzyme--an ATPase, for example--is immobilized by a lithographic method; an integrated circuit sensor detecting the slightest thermal variations; a 1 mm x 6 mm microbiosensor using silicon technology for its three electrodes, one of which serves as reference; a glucosensor whose enzyme membrane is applied to the

carbon electrode by printing; and finally a large number of ultramicrosensors all mounted on a single chip and capable of distinguishing nearly 100 different components of a taste or smell.

#### Biosensors: From Broad Spectrum to Miniaturization

Prof I. Karube revealed that he would henceforth devote all his efforts in improving biosensors to increasing their sensitivity and reliability, miniaturizing them in order to create a family of implantable sensors for medical or veterinary use, broadening their detection spectrum for the agrofood sector and creating a range of disposable minibiosensors that could play a decisive role in the future.

The current industrial status of biological sensors and the extent of their market penetration were described by Prof Pierre Coulet from the Claude Bernard University in Lyon. Although more than 20 biosensors have been marketed worldwide, amperometric-detection enzyme electrodes are still the most common. French research has produced three distinct models: the interchangeable-membrane multiparametric Enzymat, developed in the laboratories of Prof D. Thomas (conference chairman) at the Technological University of Compiègne and marketed by the Seres company; a digital-display glucoprocessor, developed by the Tacussel company in Villeurbanne in cooperation with Prof P. Coulet's team and the lactate AL7, developed by the Paul Sabatier University in Toulouse and sold by SGI (Setric [Industrial Engineering]). Glucose and lactate biosensors have also been created in the United States by Yellow Springs Instruments, Universal Sensors, Inc, and Provesta Corporation (a Philips subsidiary). Other sensors are being developed at Thorn Emi and the Cranfield Institute in the UK, at the USSR Academy of Science, at Radelkis in Hungary and at the Science Academy in the GDR. However, Japan reportedly still has the most prolific biosensor market in terms of the variety of instruments available and the number of companies involved.

We must continue our efforts in protein engineering both to increase the stability of biocatalyzers now in use and to obtain a range of higher-specificity enzymes (via strain screening and genetic engineering) to meet the growing need for multipurpose biosensors.

However, bioelectronics takes us even further. Because it became impossible to further reduce silicon integrated circuits given the density of electronic components, the switching times (Footnote 5) (Latent period between the times when the transistor is closed and open) and the quantity of energy to be dissipated, new substrates and new carriers had to be found for data processing systems. The use of organic materials (of chemical or biological origin) as substrates for basic processing and their assembly into supramolecular structures seems to be an answer to these problems. These complete molecular devices could function like a chip: detecting, transporting and storing data.

## A New Discipline: Molecular Electronics

"Molecular electronics will eventually duplicate or replace conventional electronics," stated Mr A. Barraud of the CEA [Atomic Energy Commission] during the roundtable discussion (chaired by Joel de Rosnay) at the end of the conference. According to Prof Jean-Pierre Launay, molecules performing the functions of a diode, resistor or transistor could be created. With this in view, his laboratory at the Pierre et Marie Curie University is studying the propagation of electrons in natural structures and is even trying to modify molecular structures in order to improve them for signal processing. Conjugated molecular films (Footnote 6) (Large linear molecules in which every other covalent link is double) having a ruthenium atom attached to one end and a cobalt nucleus to the other have been created, and their suitability for electron transfer has been tested and improved. The same experiments are now being done on films with a central biological component, a protein chain, for example. The ability of cytochrome C to execute basic processing of a data signal is a promising field for investigation. A ruthenium oxidation--reduction [redox] site was developed on the outer face of the molecule, as more specifically a supernumerary redox site capable of initiating the propagation of its reduced state toward the intramolecular space and up to the inner hemic site. The electron transfer speed inside the cytochrome C structure has been measured (Footnote 7) (Speed: 30 S-1). It would seem that it depends greatly on intrinsic factors and, in particular, on the position of certain key amino acids. (The presence of a phenylalanine in position 87, for example, seems critical: Experiments with site directed mutagenesis have shown that replacement of the phenylalanine in position 87 residue with a serine reduces electron transport speed by a factor of 10,000.) No doubt now remains about the extraordinary benefit of coupling a biological polymer and an electronic system in data processing. Current research by Prof Launay is focused on development of switching molecules (with two stable states), in which the transfer of a signal would be fully controlled, held back or initiated on command. Molecules functioning according to the principles of the binary 0-1 code (Boolean algebra), as it were.

The paper read by Dr A.P.F. Turner from the University of Cranfield (UK) confirmed the undeniable advantage of modifying protein structures (by chemical treatment in this case) to extend their transfer capability and their sensitivity.

Another milestone has already been passed in the maze of research necessary to develop biosystems for complex data processing: supermolecular architectures linking elementary circuits. Langmuir-Blodgett membranes offer real hope of interconnecting the molecules. According to Professor Barraud, they constitute an ideal basic material for molecular electronics and, significantly, they have already produced spin-offs in areas entirely separated from electronics in some cases: very highly adhesive films used as permanent and final lubricants, ultrathin insulators (1 microfarad per square cm), transparent optical films, ultrathin polymerizable films, conductors or even films that double or triple nonlinear frequencies (a very important property in photonics).

However, there is one disappointment: The Langmuir-Blodgett method, whose first applications are now emerging, was developed in French and German laboratories, but the industrial application was made abroad, in Japan and the UK. "It is essential that our manufacturers realize the economic importance of these membranes for greater competitiveness in selective fine chemistry and molecular electronics," Mr A. Barraud concluded.

#### Biomimetic Intelligence

Another field of research which opens up countless prospects in bioelectronics is the study of biological structures organized as data processing systems. Understanding and controlling the natural mechanisms for detecting, transporting, storing and retrieving stored information could serve as a model for the creation of new systems. Prof M. Thellier (University of Rouen) presented his work on message integration and on its recovery during morphogenesis in a plant, *Bidens pilosus*. In the absence of any unusual disturbance, these plant shoots develop a bilateral symmetry characteristic of their species. A painless mechanical or chemical stimulus (Footnote 8) (Pinprick, soft rubbing, deposit of a drop of salt water, etc.) applied to one of the cotyledons causes a break in symmetry. These signals of asymmetry are believed to be picked up near the principle cotyledonary nerves and translated into transportable and permanently storable information.

"The study of such relatively simple systems appears to be a necessary passage for molecular electronics and offers many innovative ideas for development," notes Joel de Rosnay.

The concept of an integrated approach to electronics and biotechnology leading directly to the idea of biomimetic artificial intelligence is constantly gaining ground. The BRAIN (Basic Research in Adaptive Intelligence and Neurocomputing) program, presented by Mr Saint-Remy at the end of the conference, has just been adopted by the European Communities. (Footnote 9) (Budget planned for the years 1987-1988: 20 million ECU. Project leadership: Dr G. Toulouse (Physics Laboratory, Ecole Nationale Supérieure, Paris), Dr E. Rolls (Department of Experimental Psychology, Oxford), Prof D.J. Wallace (Department of Physics, University of Edinburgh), Dr C. Von Der Malsburg (Department of Neurobiology, Max Planck Institute, Goettingen), Prof W. Singer (Max Planck Institute, Frankfurt) and Prof G. Parisi (Department of Physics, University of Rome 1. Source EC COMMISSION PRESS RELEASE)

Similarly, both of the BICEPS program for applying advanced microelectronics in research and the BIONIC project for using biological elements in data processing structures will soon be submitted to the Council of Ministers and will be the subject of a future request for proposals.

Molecular electronics definitely seems to have moved beyond the area of futuristic projections, despite many problems to be resolved before building sophisticated molecular structures with elementary circuits providing functions such as data entry, transmission, processing site control and output. Closely linked to the expansion of biotechnology, particularly to protein and genetic engineering work, the first concrete laboratory activities allow us to glimpse at what tomorrow's electronic tools will be.

## FRG'S RIESENHUBER ASSESSES NATIONAL BIOTECHNOLOGY R&amp;D

Braunschweig BIOTECHNOLOGIE in German Jun 87 p 8

[Excerpts] On May 19, Federal Minister of Research Dr Heinz Riesenhuber, speaking before the press in Bonn, presented an initial interim evaluation of the FRGs biotechnology program.

"The federal program for promoting "Applied Biology and Biotechnology," published on 11 July 1985, is primarily focused on the research policy aspects of the development of a new key technology, the resolution of federal presence and future problems--such as in environmental research, for example, medical and agricultural research, and improvement of the conditions for innovation in industry.

The funding supplied for the program, which increased from approximately DM 111 million in 1984 to DM 213 million for 1987, has proven to be necessary on the whole. The major areas for which these funds were used are microbiology, cell culture and cell fusion technology, bioprocess engineering and enzyme technology, as well as plant and animal research. A host of interesting specific examples and concrete solutions to problems can be named:

--Biotechnological wastewater treatment procedures for industrial wastewater that is heavily polluted or contains environmental chemicals difficult to decompose, such as are produced in dairies, breweries, cellulose and waste-paper plants. Basic research on microbiological decomposition lays the groundwork for this.

--Biological clean-up of soils severely polluted with organic chemicals: A research group called "Biological Conversion of Dioxin-Related Compounds" was established in 1986 for the purpose of developing ways to remove dioxin from soil by using microbial organisms. Its objective is to isolate micro-organisms that break down toxic substances such as dioxin, furan, PCP and PCB, and to develop purification techniques.

The biotechnological development of alternative methods to animal experimentation has also be increased considerably since summer 1985. This included approving 24 industrial projects--most of them as cooperative projects in conjunction with universities.

The studies currently in progress are concentrating particularly on which types of animal experimentation are used in practice, the specific scientific problems for which they are used and how they can be avoided. Future tasks in this area include evaluating different test models, interdisciplinary studies with industry, and the design of simulation models at the computer level.

The funding for the development of alternative methods in the research group between industry and colleges has been increased markedly in the last few years. Research projects in the field of gene technology receiving support are concentrating on, among other things, the cultivation of influenza viruses as well as human and animal pathogenic herpes viruses, on the development of vaccines against the AIDS virus or against parasitic diseases such as malaria, on problems in biological plant protection, and on how to evaluate the risks of artificially induced herbicide resistance in commercial plants. The number of group projects receiving support has been increasing; approximately 40 projects were involved in 1986.

The expansion phase of the gene centers founded in Cologne, Heidelberg and Munich in 1982 has been completed. Additional centers in Berlin, Hannover, Hamburg and Stuttgart have also been established. The centers have proven to provide valuable scientific impetus for research in industry and colleges. In addition, the gene centers have also shown themselves to be a successful instrument for supporting up-and-coming researchers.

Some of the main research areas include the development of cultivated plants with increased salt tolerance and disease resistance and immunobiological questions regarding the understanding of the structure of human antibodies, since specific combinations of the antibody genes represent a risk factor for certain rheumatic illnesses.

The annual BMFT contributions are approximately DM 18 million just for the centers in Cologne, Heidelberg and Munich. Added to this are various contributions made by the respective states. An agreement was reached with the state of Hamburg to create an additional research project in the area of "Molecular Neurobiology and Applied Molecular Biology of Plants" this year also. Methods in gene technology will also play a central role in this project. Some of the objectives of this research are to increase pest resistance or cold tolerance in cultivated plants and to improve the utilization of nutrients by plants.

The indirect specific support program "Biotechnology for Small and Medium-sized Businesses," which was started only in April 1986, already approved DM 11.3 million in funding through the end of 1986. The companies in turn have added approximately DM 20 million of their own to this figure. If the program is broken down categorically, companies in the following areas are the most prevalent: apparatus and equipment engineering, bioreactor development, developments for the preparation of products and for biochemical procedures in laboratories. The funding is also being used for the development of biotechnical procedures with cells and microorganisms important in industry.

Altogether, the federal government's program for "Applied Biology and Biotechnology" in conjunction with the independent activities of the states, the research support organizations and industry has visibly advanced in basic research as well as economic and technological development in this field in a broad number of areas. This course of action will also be systematically pursued in the future."

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## BIOTECHNOLOGY FUNDS FROM BMFT INCREASE ANNUALLY IN 1986-1988

Duesseldorf VDI NACHRICHTEN in German 29 May 87 p 15

[Text] The Federal Minister of Research, Heinz Riesenhuber, wants to promote biotechnology at "sharply rising rates of increase". The purpose is to establish the basic framework for making this key technology more successful in the marketplace than previously. Riesenhuber expects initial breakthroughs to be in genetic engineering products in medicine.

A status evaluation of the biotechnology program of the Federal Ministry of Research found that the scientific capabilities in this area are now available. The FRG has made considerable progress in catching up with the rest of the world. This progress is due in part to the seven gene centers now in operation and to the promotion of basic research projects in conjunction with colleges and companies in industry, such as the institutional promotion of, above all, the Society for Biotechnological Research.

BMFT funds for biotechnology almost doubled from 1984 to 1987--to DM 213 million. A double-digit growth rate is also projected for 1988. In addition to the institutional funding of DM 69 million in 1987 (1986: DM 59 million) and the expenditures for the gene centers, which remain unchanged at DM 26 million, major funding is being supplied in the following areas: microbial research and genetic engineering at DM 16 (1986: 17) million, cell culture and fusion at DM 16 (12) million, bioprocessing engineering and enzyme technology at DM 22 (12) million, as well as regenerative raw materials at DM 14 (11) million. Almost as much funding is now being supplied for the development of alternative methods to animal experimentation as for plans for animal experimentation itself; combined with the expenditures for biological safety, the total for this area is DM 20 million for this year (1986: DM 17 million).

The slightly more than DM 11 million spent from April to December 1986 for the new, indirect-specific promotion program "Biotechnology for Small and Medium-sized Businesses," for which DM 100 million have been earmarked for a five-year period, have been met with another DM 20 million from the businesses themselves. This particularly applies to apparatus and equipment engineering, the development of bioreactors and the preparation and reprocessing of products, as well as to biochemical laboratory procedures.

## ACTIVITIES, PLANS OF PLANT GENETIC SYSTEMS REVIEWED

Brussels LA LIBRE BELGIQUE in French 7 May 87 p 20

[Unsigned article: "A Green Revolution"]

[Text] PGS, pride of Flemish biotechnology, will be one of the unquestionable stars of FTI.

Somewhere around Gand there is a company, Plant Genetic Systems (PGS), whose ambition is equal to its worth. Confident of its exceptional expertise in plant genetics, PGS is a world leader, if you please, in the slot which it has in fact developed. There is nothing surprising about this after all, since one of its founders is the man who has given the scientific world the key to the vegetal genome, Prof Marc Van Montagu, of the University of Gand.

Created in 1982 with a starting capital of 400 million FB (very recently increased by 270 million) loaned by the Regional Investment Company of the Flemish Region, the Tirlemontoises Raffineries, the Gant company Radar (cattle feed), and Hillehog (seed company, subsidiary of the Swedish group Volvo), PGS has also signed research contracts amounting to 350 million with these partners.

About 100 high level researchers are presently working under the scientific guidance of Prof Van Montagu, in addition to special relations with exceptional university centers at RUG, ULB, and KUL, in more fundamental research.

## Research Orientations

PGS' starting aim was plant genetic engineering. Two other research orientations were rapidly grafted onto it, the genetic manipulation of ecologically interesting microorganisms, and protein engineering of enzymes for industrial applications.

Developments in plant genetic manipulation have already been discussed in the 30 December 1986 issue of our paper. Through this technology, PGS has developed plants which produce their own insecticide, and what is more, an insecticide which is harmless to man. Also, by introducing an enzyme-coding gene in the genome of tobacco, potato, or tomato plants, the Gand company has recently succeeded to produce species that resist specific herbicides. The commercial interest of this discovery is considerable, since it should allow growers to appreciably reduce their herbicide expenses, which represent three to four times the cost of seeds.

### Boundless Ingenuity

In the same light, PGS is considering how to endow plants with resistance to some viruses that are their natural predators. The principle is always the same: cause the plant to form a foreign enzyme able to inactivate the enemy. But plant genetics can have an even greater potential for mankind by improving the nutritional value of crops, such as the beans that are the foundation of South America's food supply; or as in the case of the latest development, by causing sweet water algae to be indigestible for mosquito larvae in regions where malaria is rampant. Ingenuity seems to have no bounds.

In nature, plants and bacteria live in symbiosis, and bacteria genetics is much simpler than the genetics of the vegetal kingdom. It was therefore predictable that the PGS researchers would undertake crop improvement through the intermediary of these bacteria; which they did. PGS is currently pursuing a program aimed at using rhizobacteria to increase the yield of vegetable crops and to fight against some vegetal mycoses.

Lastly, with the collaboration of Prof Wodak, of ULB, PGS is entering the exciting maze of protein engineering. Here again, the market is huge, since the chemical, pharmaceutical, and agricultural food industries demand high performance enzymes to replace poorly-specific catalysts in biochemical reactions. The problem of natural enzymes is that they do not readily adapt to industrial processes. In the near future, the determination of the three-dimensional structure of enzymatic proteins, the changing of this structure by controlled mutagenesis, and even the design of entirely new molecules, could provide industrialists with "turnkey" enzymes for their manufacturing processes.

### Business

PGS is not only a research and development company; it is also a commercial enterprise run by a team of businessmen with a solid industrial background. The business plan is clearly established until 1995. So far, most of their achievements have been financed by industrial partners. At present, the company is beginning to develop its own products which will be made and sold either in joint ventures, or with manufacturing licenses, or even--although probably not before the mid-1990's--by PGS itself. As one example, PGS

researchers have perfected a membrane that can filter very small proteins, but which has proven to be so useful in their protein engineering work that they have obtained a worldwide patent on it. Since at present they have neither the time nor the complete infrastructure for mass producing and marketing this spinoff product, they have signed a contract for the patent's utilization with Janssen Pharmaceutica. The company also mentions a new software for graphic representation of proteins, but it is still too early to say any more about it. We will probably learn more after the first of June.

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## FRENCH CNET'S AI ACTIVITIES REVIEWED

Le Chesnay BULLETIN DE LIAISON DE LA RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE in French Feb-Mar 87 p 31-33

[Article by Felix Hautin of the "Structures and Software for Switching" division at the CNET Lannion A center: "Artificial Intelligence"; first paragraph is source introduction; numbers in brackets refer to the bibliography]

[Excerpts] This article gives a general survey of current studies related to artificial intelligence (AI) at the AIA (Artificial Intelligence Applications) department of the CNET [National Center for Telecommunications Studies] Lannion A center. Developments in logic programming related to basic artificial intelligence tools are presented in the article by S. Bourgault and G. Barberye in this bulletin. The presentation is subdivided into a concise historical record of the introduction of these techniques at CNET, followed by an overview of current studies and their impact on the operating services. Reference is also made to outside cooperation.

## Background

Interest in artificial intelligence techniques at CNET resulted in the creation of an "Artificial Intelligence Applications" department entrusted with applied research in AI methods and techniques and with their use and promotion in telecommunications, both for visible subscriber services and for the actual operating services.

This department employs a staff of 15 and has its own computing facilities (DEC, SM90, PC) and is about to be equipped with MAIA [machine for AI applications] devices.

## Current Studies

Current studies follow four main streams: information related to the yellow pages of the telephone directory, the reuse of software systems, expert system applications and artificial intelligence techniques.

All these studies have an application bias corresponding to a well-defined telecommunications requirement. The choice of goals, however, was greatly

influenced by their application for AI methodology. This is the case for information that requires the use of natural language understanding techniques. Only the work related to [doctoral] theses is governed to a lesser extent by telecommunications requirements. This is the case for cooperation models between expert systems, but there is no doubt that these techniques will find numerous future applications such as diagnostics in networks and electronic switching systems.

#### Study of Information [Related to Yellow Pages]

The study addresses three aspects:

##### 1. Definition and Realization of a More Elaborate Representation of Inquiries

At present we have built a syntactic-semantic analyzer based on the work of M. Rady [5]. This analyzer is integrated into a representation language based on semantic strings. Research on the acceptance of poorly formulated inquiries [6] has allowed for extensive inquiry entry. Efforts are now concentrating on the extension of the model to better accommodate time aspects, for example.

##### 2. Dialogue Models

With inquiries--in other fields where natural language finds applications the same constraint exists--it soon became obvious that not only a question must be processed, but also a more complex exchange intended to improve the precision of the request. This aspect involves not only knowledge representation techniques but also the generation and execution of patterns which allow speech to be modeled and the meaning of the user to be understood. This study benefits from work done in the field of voice communication (Speech Recognition Team at CNET). Current work aims at building a prototype.

##### 3. Improvement of Knowledge and Human Reasoning Representation Methods and Related Tools

The currently used (KLONE) model based on the principle of semantic strings [7] is restrictive for knowledge of an assertive nature. Therefore, we are also attempting to expand this model by adding a logical component introducing model operators such as "want" or "know." These extensions seek to solve the natural language representation problem even though developments may find applications in other areas.

This study is linked to the development of a project to define an inquiry system similar to the yellow pages of the telephone directory, offering spoken and written access in natural language to the general public. The integration of various techniques is being studied, including knowledge representation, reasoning, speech recognition and synthesis, natural language processing and dialogue in the context of an application using a scaled-down subset of the yellow pages. The project was launched with an initial system specification.

## Reuse of Software

This study is intended to provide interactive aid in the design of software systems based on "components" (modules, functions, algorithms, etc.) by taking into account information used in the earlier design of a similar system. This solution appears to be common to all developments of huge software systems with a long life span that are continually upgraded, as is often the case for telecommunications software.

The artificial intelligence aspects studied and used in this context are mainly knowledge and human reasoning representation methods. They are applied to previously defined design diagrams and to the reuse of components and design structures.

A first level, called SIBEMOL, has been achieved and corresponds to the configuration stage of software systems [8]. The latter are modeled by means of elementary components (interface, body) and functional structures breaking down the system into subassemblies. Rules for the correct analysis of the system are also defined. A configuration algorithm has been defined and built allowing the construction of a software system or subsystem meeting a number of criteria (mandatory use of certain components, the exclusion of others, while the components themselves must meet one or several different criteria, e.g., dates, revisions, etc.). The application on which this approach was tested is a subassembly of the E10 electronic switching system software.

The next step of this stage is part of the ESPRIT project called KNOSOS. The participants are ESI, Matra-Espace, Dornier, Alcatel and Yard. This project aims at extending previous models by evaluating them against specific software systems developed by the industrialists involved in the project. The project also aims at extending this method to more abstract components, thus assisting software design by uniting these components.

The next stage concerns the reuse of design structures. To do so it is necessary to study design pattern representations and subsequently to develop mechanisms allowing the reuse of these patterns. Current work is focused on the exact identification of problems related to the reuse of design patterns and components as well as on the study of useful basic techniques such as analogous reasoning.

## Applications of Expert Systems

Started last year, this activity will consider the requirements of various telecommunications facilities. These requirements involve both improvements to operating functions (e.g., diagnostic aids for electronic switching systems and dedicated lines) and training tools (e.g., fault simulators, system malfunction simulators).

A number of developments are in progress including aids for the digitization of the local network for 2-Mbit/s digital transmission systems, an expert system for training operators to cope with a possible malfunction of the exchanges, a support system for planning training courses, an aid for

interpreting alarms from the TRANSMIC system, a breakdown analysis prompt system for dedicated lines and the development of support methods for operators in the event of malfunction. The activity is performed in cooperation with the operating services. The outcome will be the availability of evaluation models installed in the operating services.

#### Artificial Intelligence Techniques

This aspect comprises in-depth studies in artificial intelligence that are not directly linked to explicit telecommunications requirements. Studies in progress are the subject of [doctoral] theses. They include explanation mechanisms in expert systems, a cooperative expert system architecture (MEDIA) and analogous reasoning.

Other research has been done on problems of managing sets of contradictory facts in a knowledge base and in object-oriented languages.

Furthermore, knowledge of the commercial tools is a constant concern even though the developments have been made with tools designed and built by CNET, which is thus better able to control with constraints that applications impose on designs.

#### Outside Cooperation

Independently of normal contacts and exchanges between research laboratories, the AIA team works in GRECO-PRC AI [Group of Coordinated Research-AI Project] on the subject of expert systems development methodology (subject 4) and on the subject of training and analogous modeling (subject 2).

Outside the framework of the ESPRIT (KNOSOS) projects on which we are working with industrial and research organizations, we are collaborating with other French teams such as the LIMSI [Information Laboratory for Mechanics and Engineering Sciences] (G. Sabah) for aspects related to natural language and dialogue, and the GRTC [not further identified] at Marseilles (E. Chouraqui) for analogous reasoning.

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## DORNIER JOINS DEFENSE MINISTRY CAE PROJECT

Friedrichshafen DORNIER POST in English No 1, Jan 87 pp 42-43

[Article by Dr Manfred Mall, "Computer-Aided System Engineering: CASE"]

[Text] In the field of military systems development – but not only there – the current situation is characterized by an increasing sophistication of products due to higher and more complex operational requirements, the transfer of many systems functions to the electronic level, and by the rapid technological progress in the design of electronic systems and components with a tendency to form islands at the tool level. At the same time it is true, however, that development times remain long, development costs keep rising, and a longer operational service life is required from the systems (evolution principle). Consequently, the designer is faced with the following requirements:

- Need for increased system-level capabilities in order to meet the demands for higher product sophistication, specialized design teams, and the multitude of development tools
- Rationalization of development methods in order to reduce project implementation times and development costs
- Improved product support over long periods and adaptation to changing requirements.

Some essential steps to fulfil these requirements are: the systematization of development processes, the design of corresponding tools, and the development of communications and documenta-

tion standards as prerequisites for long-lasting, stable systems documentation, i.e. a documentation which is independent of tools and adaptable to modifications.

#### Program

CASE is a joint venture of the companies BGT, Dornier, and MBB, the Fraunhofer-Gesellschaft (IITB), and Hanover University (INT). The program is controlled by the Federal Ministry of Defence (BMVg) and financed by individual contracts between the BMVg and the project partners. The CASE partners have concluded a cooperation agreement, and work started in autumn 1986.

The program objectives are:

- design of a continuous tool concept for the planning, implementation, and support of military electronic systems in hardware and software;
- definition of the required methods, procedures, and tools on the component, equipment, and system levels;
- creation of a procedure which permits the communication between different tools and allowing, as well as requiring, a long-lasting stable documentation;
- integration of tools and methods.

## Concept

The attempt to build a comprehensive computersized tool system for the complete development process of military equipment is rather hopeless, if not useless. Such a system would be extremely big, very expensive in design and development, and – due to the small number of anticipated users – probably unstable technically. Tools for partial tasks are available on the market, including product support and very quick innovation. At present, the service life of these tools lasts only a few years, while military equipment has a service life of more than 15 years. This must be taken into account when developing a tool system: All tools need to be exchangeable and renewable; data generated by the tools – they are the development results – must be representative, complete and suitable for processing by other tools at any time.

As a starting point for the cooperation of the partners, a system concept with the following characteristics has been proposed:

- Each tool receives and supplies data over a data bus
- Only generative data, i.e. data allowing the reproduction of an equivalent product as they describe it, are put on the data bus
- The data format on the data bus is standardized, but must be expandable
- Tool-specific data and results, such as documents, drawings, etc. are treated separately, like traditional data

This concept ensures the exchangeability of tools, allows a stepwise development and long-lasting stable documentation by means of the generative data. Of course, this concept does not exclude the use of previous means of documentation, it rather complements them. Another important feature is that such a complicated project can be only implemented this way in cooperation with partners, some of whom are even competitors in certain fields.

## Main Activities of the Partners

In coordination with the overall concept, the client and the contractors have agreed upon the following division of work:

Dornier: work on the equipment and systems level

MBB: tools for work on the weapons system level

BGT: densely-packaged electronics

IITB and INT: selected subjects; scientific support of the work

All partners: definition of the data bus.

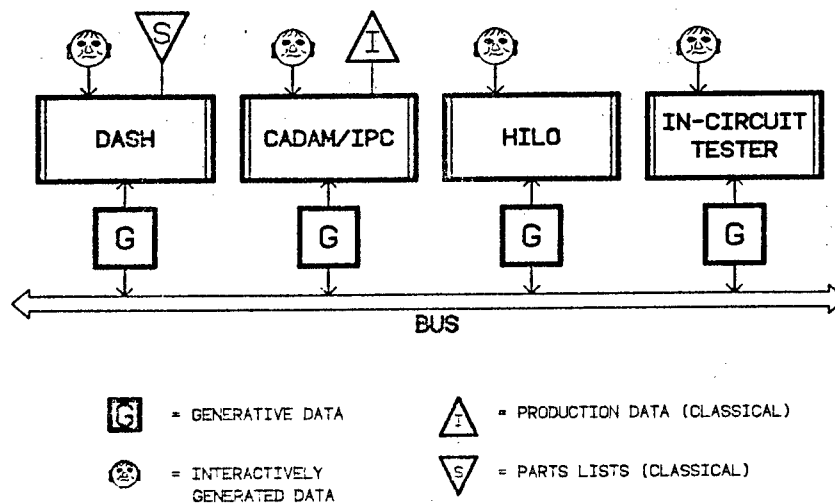
## The CASE "Equipment" Subsystem

Development and production of military equipment has to take into account special collateral conditions: small production numbers, very long development times, very long service lives, and high sophistication. This leads to the following problems and conclusions:

- Development without computer-aided tools can no longer be justified for cost reasons.
- Detailed equipment development is possible only in a restricted way by means of pre-series products. The development quality must be ensured by constructive measures.
- Long service life and lack of detailed development lead to in-service modifications and improvements – and this may last for decades. Therefore, measures for result assurance, configuration control, and documentation are of special importance.
- Due to the long development time, it cannot be guaranteed that the development tools will outlast this time. It is very important, therefore, that the data generated by the tools – they represent the development result – are available in the archives in a form which is independent of the tool and can be further processed by machines.
- Due to the complexity of the equipment and the necessity that development quality must be ensured by constructive measures, the designer must have a vast knowledge at his disposal, and this volume can no longer be processed without machine support.
- The size of the equipment and systems always requires work-sharing in the development stage, leading to interfaces and allocation problems.

It is planned to build up the CASE "equipment" subsystem in the next two years from existing, commercial or – if necessary – newly developed tools as a "rapid prototype".

Each tool is to be used immediately and thus productively. Upon conclusion of the project, it will be possible to provide continuous support during the most important steps of an equipment development.



*Part of the overall system with the development tools for equipment wiring (DASH), the plug-in boards layout (CODEM/IPC), circuit verification (HILO), and the PCB test in production (in-circuit tester)*



## DORNIER WORK ON ESPRIT, MILITARY AI PROJECTS DESCRIBED

Friedrichshafen DORNIER POST No 2, Feb 87 pp 56-58

[Article by Werner Kerber, Antoinette Kieback, and Michael Lindner, "Software Engineering for Information Systems with AI Technology"]

[Text] Information systems, that is systems for the acquisition, processing, and transmission of information, have conquered more and more fields of application over the past years due to the development of new technologies. Of necessity, the complexity and the demands on such systems grew accordingly. For the design of information systems, various tools have been used so far, such as graphical representation mechanisms for requirements analysis or support components for data analysis in order to assist the individual stages of software design. It soon became obvious, however, that these tools are no longer sufficient for more sophisticated system developments.

Intensified research and development in the area of knowledge-based systems and the new tools and methods created for this purpose opened the path to better qualified software development which should lead to more efficient information systems. Dornier is mainly working on the implementation of tools for the design of office information systems within the TODOS ESPRIT project (Automatic Tools for Designing Office Systems) and for Requirements Engineering (RE) within the REMIS (Requirements Engineering for Military Information Systems) experimental study of the Federal Procurement Office (BWB). Several LISP machines (Explorer, made by Texas Instruments and Xerox 1108) are used for this purpose together with the KEE expert system development tool (KEE = Knowledge Engineering Environment supplied by IntelliCorp).

## TODOS

TODOS is a project within the ESPRIT programme, financed by the Commission of the European Communities to the tune of 50 per cent. This project from the office systems field is to facilitate and accelerate the development of office information systems (OIS) and to make them more reliable. Analysts, designers, and users of office systems are to be provided with development tools helping them to design and implement more efficient office environments. In this context, TODOS investigates technologies and solutions for the collection of design data, for rapid prototyping, and for the selection of a suitable system architecture and subsequently implements them in an OIS prototype. The TODOS project, started under Dornier's leadership in January 1986, is to be presented in detail here.

The TODOS project is subdivided into four work packages, which are each treated in close cooperation by the individual partners of the contract. These work packages (WP) comprise the following tasks:

WP1: Requirements collection and analysis for OIS

WP2: Logical design and description of system components

WP3: Rapid prototyping with OIS tools

WP4: Design of suitable OIS architectures

The design sequence for a computer-assisted office information system can be represented by a cycle. Starting from an actual OIS, the user requirements for the system under design are set up and ana-

lysed. These requirements are subdivided into functional and non-functional requirements. The functional requirements are integrated by means of a logical design into a conceptual model to describe the OIS. This model is the basis both for the development of an OIS prototype and for the design of a suitable OIS architecture, which also takes into account the non-functional requirements.

The OIS prototype created by rapid prototyping is tested for functionality by the user. Necessary modifications are integrated into the functional requirements and analysed. This cycle is repeated until the prototype corresponds to the user's functional requirements. After that, design of a suitable OIS architecture is started which can lead to changes in the functional and non-functional requirements when tested. Special design tools are developed for treating the individual work areas.

The field of requirements collection and analysis (WP1), which is treated by the French company Sema-Metra and the Italian firm Italtel, serves to investigate user requirements for future office information systems. The results of these investigations then are evaluated with suitable tools in an analytical stage in order to obtain correct and complete specifications of user requirements. It is hoped that the most important requirements of the future office will be investigated in this way and at the same time the weak points of present OIS environments will be discovered. The logical design (WP2) of these OISs is elaborated in cooperation by the French software company Thomson Informatique Services, the Polytechnical Institute of Milan University, and the Informatics Institute Paris I University (Sorbonne). This work package is to create the development tools to describe the functionalities of future OISs by means of a conceptual model on the basis of the results of the requirements analysis.

Work package WP3 is covered by Dornier GmbH. It is concerned with the development of a tool to support rapid prototyping of office information systems. The user has defined his own office environment based upon his personal requirements by means of the requirements analysis and which is represented by a logical model. On the basis of this model,

the tool quickly generates a custom-made prototype for him. The functionalities of the OIS prototype are described by this model and can be provided by the user with the interface he desires.

The tool configuration is such that it first translates or completes the OIS model when a prototype version has been implemented. Functionalities which are used as prototype functions are stored in a library. The tool checks if all functions described in the model are contained in the library and, if necessary, missing functions are introduced by an editor.

For tool implementation, AI techniques are used on an Explorer equipment with the KEE expert system shell in a Common LISP environment. The programming method of rapid prototyping allows a fast modelling of the problem solution. The main advantage is the quick setup of a prototype which already provides the restricted functionality of the final system without fixing the overall functionality. Thus the future user can get a relatively precise impression of the different system capabilities, especially of the user interface for "his" product, at a very early stage.

The fourth work package (WP4) is being treated by the Dutch company OCE and the national Italian research centre IEI at Pisa (as subcontractor to Italtel). Mainly, feasible hardware and software configurations for future OISs are investigated taking into account the requirements analysis and the conceptual design. The characteristics of existing systems are to be investigated as well as their coupling to future OIS architectures. A simulator then helps to define feasible architectures and their capabilities.

Besides TODOS, the projects FAOR (Functional Analysis of Office Requirements) and OSSAD (Office Support Systems analysis and Design) are concerned with related subjects. For the ESPRIT-II stage, which will probably start in 1989, both a further refinement of the TODOS prototype and its tools and an integration of the results of these projects into an efficient office system environment can be imagined. First contacts in this direction have already been made.

## REMIS

A military command and control information system CCIS serves to support command and staff level tasks like

- situation assessment
- planning
- commanding, and
- control

by receiving, representing, processing, and distributing information.

The efficiency and future acceptance of fast, high technology reconnaissance and weapons systems depends on the efficiency of the military CCIS. The consequence of technical development will be that headquarters must collect, analyse, and distribute an ever increasing amount of information in less and less time. Therefore, support and improvement of staff-level work by computer-assisted CCIS is a task which will gain in importance in the years to come.

IS developers possess experience-based knowledge of the components, the general structure, and the technical possibilities to implement such systems. The objective of REMIS is to find ways and means how to use this expert knowledge in the requirements definition stage already in order to clear away differences between the viewpoints of the client and the developer as early as possible and thereby reduce the time for the setup of the precise requirements for the final target system.

The client is to be enabled to recognize and evaluate essential structures and functions of the target system in an operational prototype. Thus it should be possible to avoid later changes of the specifications or the finished software to a large extent. In addition, the system developer can use the represented experience-based knowledge by solutions which have been anticipated or which have been tested and proven their value in another situation. It can be expected that the overall time for a system development will be considerably reduced in this way.

The following paragraphs will describe the five parts of a planned RE support system and the integration of such a system into an iterative process of requirements definition.

### Conceptual model

In order to analyse an IS with computer support under different aspects, a formal representation of this system, which can be transferred to the computer, is required. For this formal representation, a conceptual model is used whose constituent parts – the concepts – can describe the structures and functions of military CCIS. The conceptual model planned for REMIS is derived from the model developed for the TODOS project.

### Knowledge base

In order to use the experience-based knowledge of the developer for the requirements definition, typical components and structures of existing CCIS are represented in the conceptual model and collected as partial solutions in a knowledge base.

### Performance descriptions

In order to represent the requirements of the target system in a formal language, a set of keywords is used, which are taken from the conceptual model. All keywords which characterize a certain structure or a function from the requirements are taken together to form a performance description. All performance descriptions together are to permit associations between the requirements and the partial solutions stored in the knowledge base.

### Requirements analysis component

Starting from the performance descriptions and taking into account the partial solutions contained in the knowledge base, the requirements analysis component constructs a model of the target system by means of a dialogue with the developer.

### Rapid prototyping tools

The target system model generated by the requirements analysis component is to be represented to the client in its structure and functions for modification and/or validation purposes. Suitable tools are needed for this:

- an interpreter transferring the given concepts into a prototype
- an explanation component allowing to trace back modelled and functions via

- partial solutions and performance descriptions down to the requirements
- a scenario component allowing to define the application environment of each individual target system.

In the RE cycle, an iterative process is used to set up the definite requirements of the target system, starting from the first set of requirements. If, during this RE cycle, new results are achieved that have repercussions on former ones, the corresponding development steps are repeated.

1. Step: User requirements

Starting from the tactical requirement, the client sets up his requirements for the target system.

2. Step: Performance descriptions

The developer identifies structures and functions of the target system in the requirements and characterizes them by performance descriptions.

3. Step: Selection of partial solutions

The requirements analysis component establishes associations between the performance descriptions and the partial solutions in the knowledge base. The result is a consistency-checked conceptual model of the target system, given by a set of partial solutions.

When the association of individual performance descriptions with partial solutions from the knowledge base is not feasible, the developer will either modify the performance descriptions or he will broaden the knowledge base by suitable partial solutions.

4. Step: Rapid prototyping

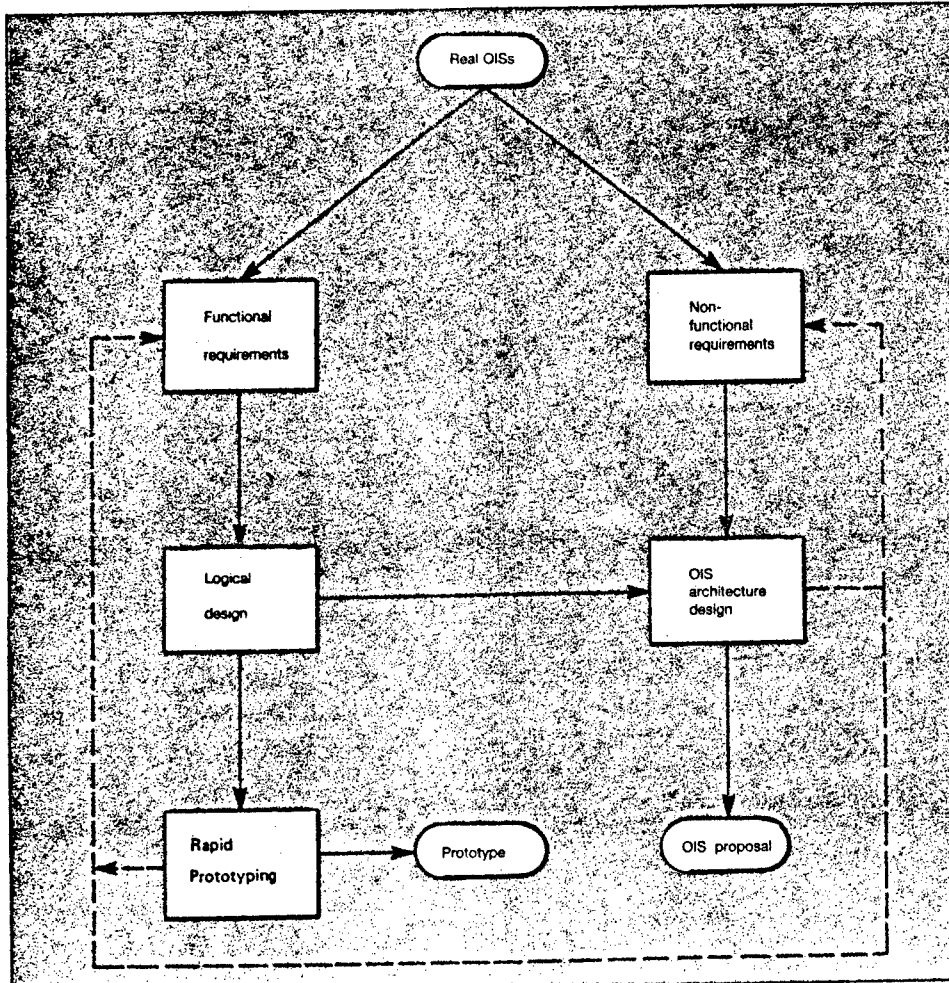
With the scenario component, the client defines the future operational environment of the target system. Subsequently,

- he can model the target system structures and functions, and
- he can analyse the relationships between the requirements and the modelled target system. By means of the rapid prototyping tools.

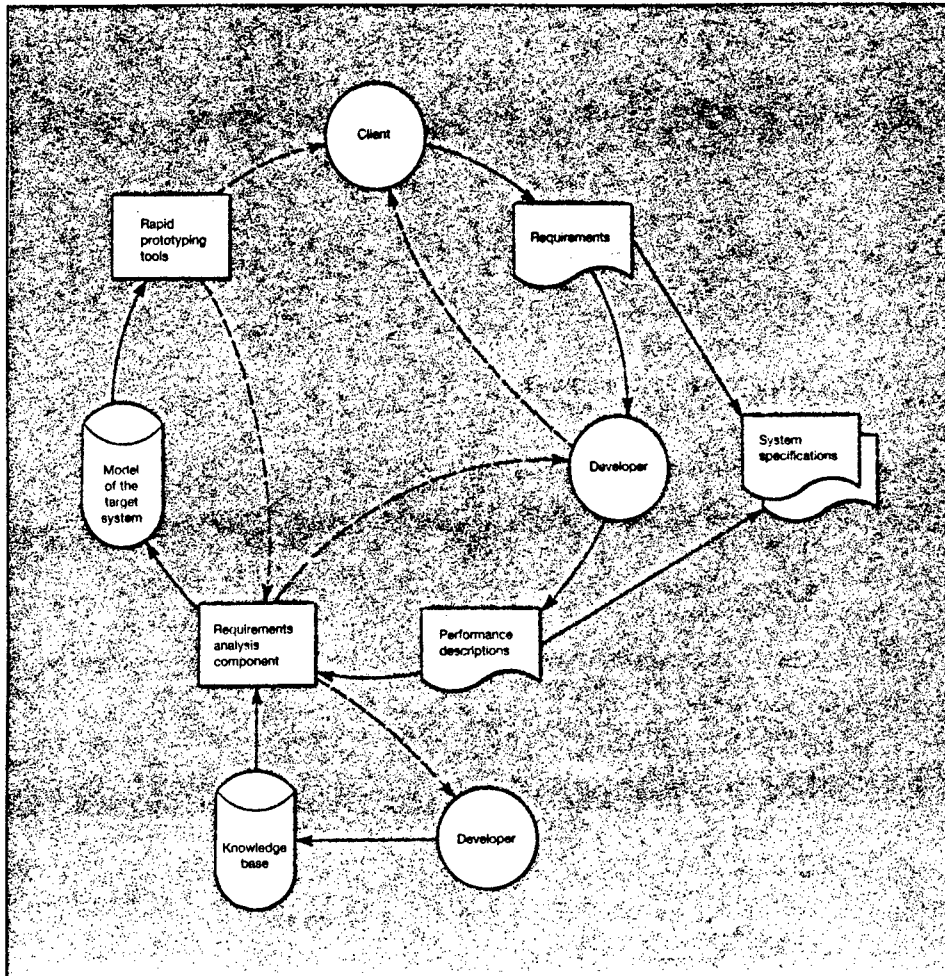
The results achieved when working with the prototype can not only lead to a change of requirements but also to a change of the selected partial solutions

by the requirements analysis component. Within the framework of the TODOS and REMIS projects, it is planned to complete the demonstrators in the course of 1987. These demonstrators will allow to identify the real application possibilities of the AI techniques discussed in this paper. ■





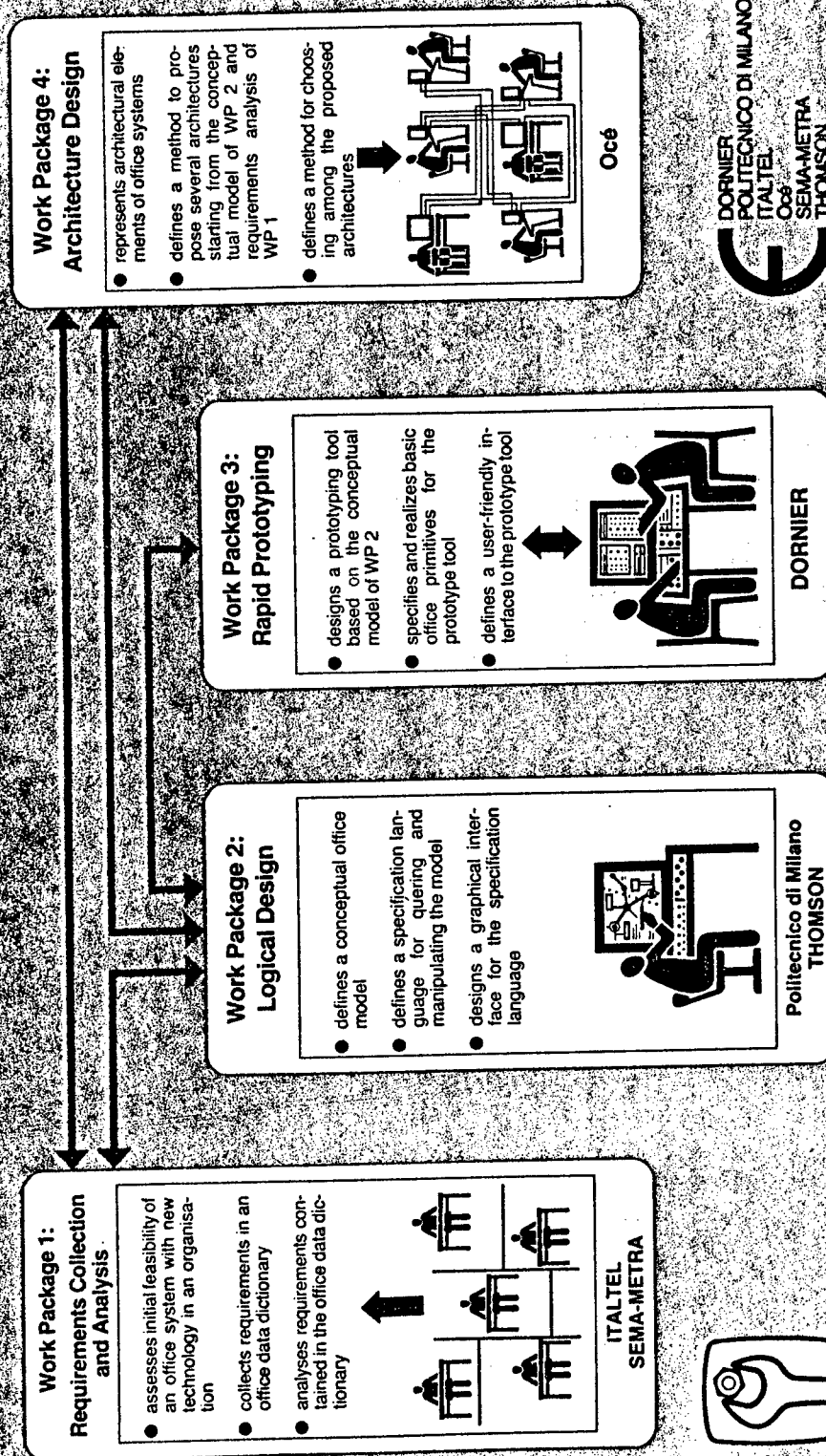
*TODOS: OIS Office Information Systems – design cycle*



*REMIS: Requirements Engineering cycle*

# TODOS

ESPRIT-Project No 813: Automatic Tools for Designing Office Systems



DORNIER  
 POLITECNICO DI MILANO  
 ITALTEL  
 Océ  
 SEMA-METRA  
 THOMSON

## BRIEFS

FRG ARTIFICIAL INTELLIGENCE CENTER--Bonn - Next year West Germany will open a computer research center at Kaiserslautern in south-central Germany that will specialize in the development of what are said to be "artificial intelligence" programs, according to an announcement made March 27 by Minister of Research and Technology Heinz Riesenhuber. The center's 60 researchers will strive to perfect software which would be able to deal with problems in the various realms of scientific endeavor by simulating the human mind's ability to reason including postulating different solutions to a given question. For the first 5 years, the center will essentially be financed by the Ministry of Research and Technology--to the tune of DM 5-10 million a year. The FRG computer industry has committed itself to providing funds thereafter. [Text] [Paris AFP SCIENCES in French 2 Apr 87 p 28] 13307/13046

CSO: 3698/527

## SURVEY OF FRENCH INDUSTRIAL ROBOTICS

Paris CPE BULLETIN in French Apr 87 pp 65-70

[Article by Marcel Bayen: "Industrial Robotics in France"]

[Text] For the last 10 years, industrial robotics has grown incessantly throughout the world. In 1985, 40,000 robots were built and estimates for 1990 forecast the production of 78,000 units in the Western World.

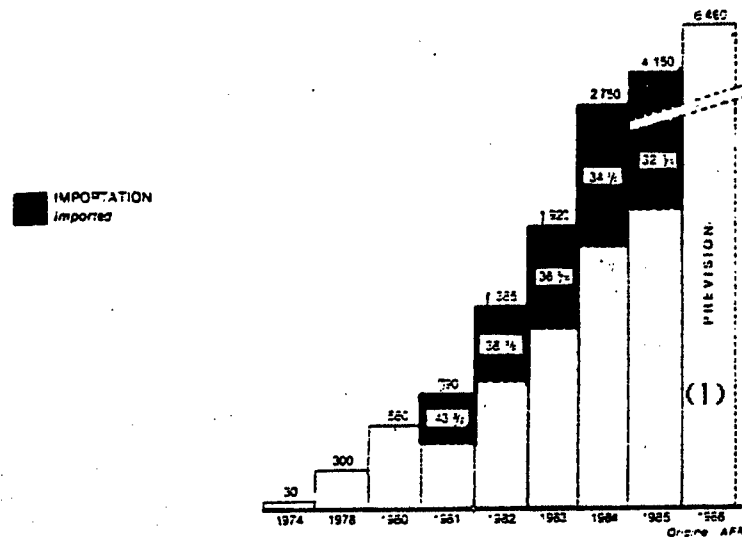
## Growth of the Robot Base in the Western World

<u>Country</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>	
Japan		16,100	16,500	24,400	Annual growth
	13,000	29,100	45,600	70,000	Total number
USA		1,750	5,000	7,000	Annual growth
	6,250	8,000	13,000	20,000	Total number
FRG		1,300	1,800	2,200	Annual growth
	3,500	4,800	6,600	8,800	Total number
France		1,260	1,140	2,550	Annual growth
	950	2,210	3,350	5,900	Total number
Italy		720	1,090	1,400	Annual growth
	790	1,510	2,600	4,000	Total number
UK		600	870	590	Annual growth
	1,150	1,750	2,620	3,210	Total number
Sweden		550	550	700	Annual growth
	1,300	1,850	2,400	3,100	Total number

## France: Fourth Largest Robot Base in the World

With 5,900 machines installed at the end of 1985 and 5 percent of world sales, France ranks fourth in the world in number of robots. Programmable robots (automatic manipulators with three or more axes) and so-called "intelligent" robots (capable of analyzing changes in their environment) represent 4,150 units, with a growth rate of 51 percent in 1985 against 37 percent in 1984.

# Growth of the Installed Robot Base in France (Source: AFRI)



Key:

1. Forecast

However, robot exports are still very weak (165 units in 1985, or 12 percent of domestic production). However, the rate of market penetration by foreign machines has dropped.

The main French industrial users by sector are: automotive (28.8 percent), mechanical (21.6 percent), plastics (14.3 percent), research/education (11.6 percent) and electricity, electronics, and data processing (6.5 percent). The main applications are: handling/loading/unloading of machines (34.4 percent), spot welding (21.9 percent), arc welding (11.5 percent), assembly (10.9 percent) and spraying (6 percent).

Although increasing since 1982, in France assembly has not yet met with the success that it has in the United States and Japan.

## French Manufacturers

There are about 30 robot manufacturers in France. ACMA Robotique is the dominant company and produced 300 robots in 1985 (400 to 500 planned for 1986). A part of Renault Automation, it has access to the automobile assembly line market (RNUR [Renault], PSA [Peugeot]). It thus specializes in so-called heavy robotics: welding, handling. After a long involvement with hydraulics, its entire range is now comprised of electric robots. Renault Automation also has a production line for assembly robots: SEIV Assemblage (AXERA line).

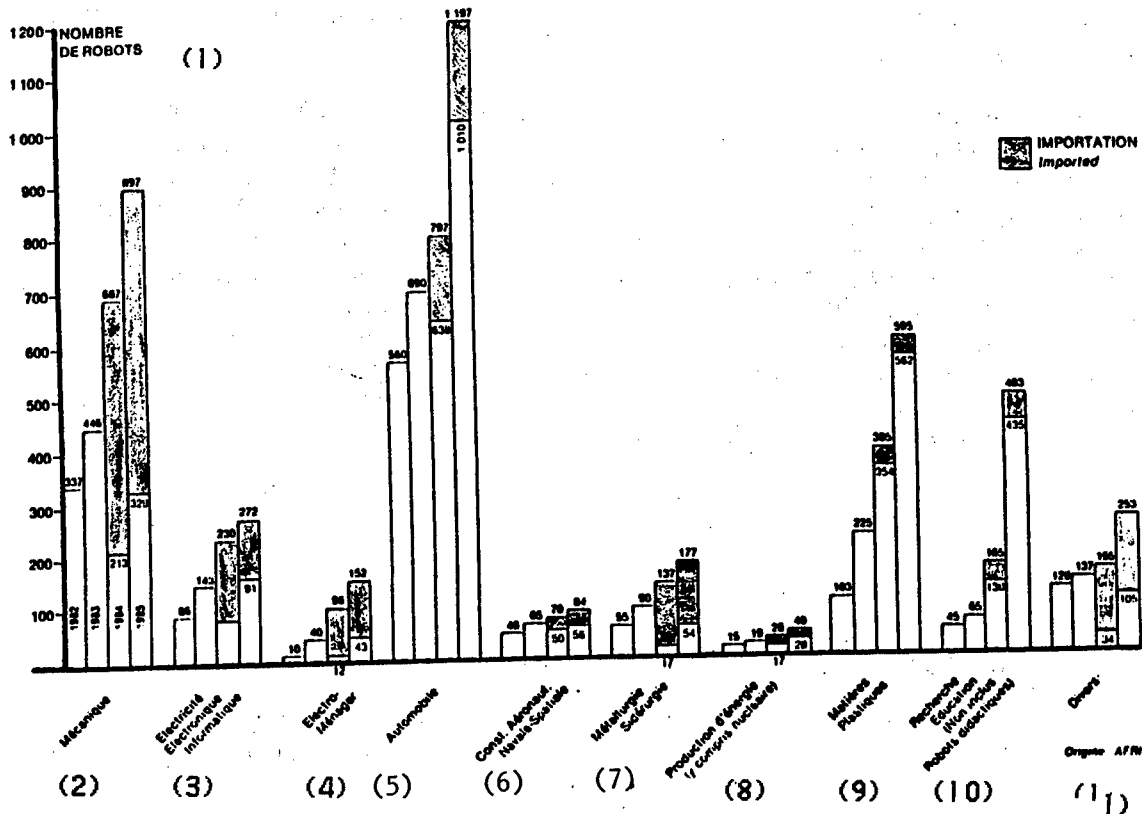
An importer comes in second in this ranking: the robotics division of ASEA France, a subsidiary of the Swedish group ASEA Robotics.

Third place is held by AKR (AOIP Kremlin Robotique), a specialist in painter robots, which ranks second worldwide after Trallfa (Norway) controlled by ASEA Sweden. The world market for painter robots is about 500 units per year, which is quite small. AKR sold 80 robots in 1985 and 60 in 1984 (of which 75 percent were exported). For that reason, the company has four subsidiaries (United States, FRG, Italy, and UK).

The other companies are all dynamic smaller companies (AID, AFMA, ITMI) where the average age of employees is low (34 years at AFMA Robots). Also to be noted is the presence of another automobile manufacturer (Citroen Industrie-PSA), companies specializing in welding (Sciaky, Commercy Soudure), companies involved in the engineering aspect of computer-integrated manufacturing (Midi-Robits, Barras Provence) and, finally, companies specializing in robotics for hostile environments: Hispano Suiza (SMECMA subsidiary) for nuclear applications, Ateliers et Chantiers de Bretagne for welding and undersea activities and SIRTES (Renault Automation), specializing in military equipment. Certain foreign manufacturers lacking a subsidiary in France, particularly the Japanese, have concluded sales agreements with French companies:

SCEMI	Adept (United States), Toshiba (Japan)
CEM	Yaskawa (Japan)
Commercy Soudure	Shin Meiwa (Japan)
Ragonot (formerly Auxilec)	Dainichi Kiko (Japan)
Robotique	
Renault SEIV Assemblage	Toyota (Japan)
Albora	AYM Automation (UK)
AID	IBM (United States), Hitachi (Japan)
AFMA-Robots	DSR Systems (UK) (subsidiary of Dainichi Kiko of Japan)
SORMEL	PENTEL (Japan)

Distribution of Robots by Industrial Sector in France (Growth of Robot Base 1982-1985; source: AFRI)



Key:

1. Number of robots
2. Mechanical
3. Electricity, Electronics, Data Processing
4. Household Appliances
5. Automotive
6. Aerospace, Shipbuilding
7. Metallurgy, Steel
8. Energy Production (including nuclear)
9. Plastics
10. Research, Education (excluding training robots)
11. Miscellaneous



Principal French Robot Manufacturers  
(Source: USINE NOUVELLE)

<u>Company</u>	<u>Sales in millions of Fr</u>	<u>Staff</u>	<u>Division of capital</u>	<u>Market Niche</u>
ACMA	227	205	Renault 100 percent	Spot and arc welding, materials handling
ASEA Robotique	130	60	ASEA (Sweden) 100 percent	Welding, materials handling, assembly
AKR Robotique	65	100	AOIP 99.97 percent Kremlin 0.03 percent	Spraying (paint)
SORMEL	65	140	Matra 98 percent	Assembly
SEPRO	40	60	Groupe Atlantic 55 percent Private backers 45 percent	Unloading of injection-molded parts, palletizing, loading lathes [?chargement de tours]
AID	35	46	F. Danel 48.7 percent Finovelec 15.2 percent Finovectron 10.7 percent Epicea 10.7 percent J.P. Auzimour 12.3 percent	Cutting, mobile robots, training robots
AFMA Robots	27	60	Telemecanique 90.98 percent Leroy-Somer 9.02 percent	Materials handling, assembly
SCEMI	25	60	Alsthom 100 percent	Electronic assembly, conditioning
ITMI	12	50	Hewlett Packard 14.16 percent Pechiney 14.16 percent Banexi, 8.2 percent Natio Innovation 5.88 percent Westinghouse 13.16 percent	Top-of-the-line robots using vision and AI

ALBORA	11	17	Ateliers Bouviers 19 percent Pierre Contegiani 25 percent J.P. Poncet 25 percent	Unloading of injection-molded parts
ELITEC	8	18	Paturle 22 percent Idef, 42 percent Private investors 25.82 percent	Assembly
ABC Productique	6	20	Jean Mouton 100 percent	Materials handling

### The Situation in France by Sector

#### Mechanics

This is the main weakness of French suppliers, especially as regards speed-reducing gears. The Japanese company Harmonic Drive has a near monopoly and supplies 95 percent of the speed-reducing gears used in robotics. To protect its position, the company has purchased a patent for a speed reducer developed in France by AID (a PME [small- or medium-sized company] in Grenoble). The monopoly could be broken by an American company, Dojen Robotic, which supplies a speed reducer also developed by a Frenchman (Michel Pierrot).

In precision mechanics, ACMA has had to turn to Turbomeca for pinions. The parts supplied are unfortunately too expensive, and the market has been taken over by a German supplier (Klingelberg). Ball bearings are also purchased abroad for similar reasons.

There is nonetheless a strong point in French mechanics: ballscrews. Manufacturers such as Ratier-Figeac, La Technique Integrale and Transrol even export their products to world leaders in robotics.

#### Motorization

French manufacturers have made progress in electric motors. For example, CEM, a subsidiary of Alstom, supplies the European manufacturers ACMA, SCEMI, ASEA, Volkswagen (FRG) and KUKA (FRG) with direct current motors (AXEM line). Ragonot offers brushless electric motors to various French manufacturers (ACMA, AFMA-Robots).

Unfortunately, differences in scale of production mean that less expensive equipment can be obtained from foreign suppliers. Thus, Mavilor Motors Infranor Inc. (United States) supplies equipment to several French robot manufacturers (ACMA, AFMA-Robots, and Commercys Soudure). However, we know of no French manufacturer currently offering direct drive torque motors for robotics.

## Grippers

The area of grippers and hands, initially dominated by the Americans, has been taken over by French manufacturers. With the help of the Laboratoire d'Automatique of Besancon, SORMEL (a MATRA subsidiary) has developed a passive compliant grip within the ARA [Advanced Automation and Robotics] program. CCMOP offers a wide range of grips for robots. It was to manufacture 500 units in 1986 and is planning to export the the FRG and the United States. SOURIAU has a tactile grip equipped with optical fibers. In addition, the technical centers of some major companies offer a whole range of grippers: SYSPRO (Pont-a-Mousson group) and CTRI (Avions Marcel Dassault group).

## Vision Systems

French industry uses 533 vision systems, of which 304 were supplied by specialized manufacturers and the others designed and manufactured by user companies. Ninety-two percent of the installed systems are French-made.

The ITMI (Industry and Technologies of Intelligent Machines) engineering company manufacturers integrated vision systems. It also offers a three-dimensional vision system using lasers. SOTEREM offers a vision system to pilot robots, and GIXI (a CISI subsidiary) has a two-dimensional vision system developed at DEIN [Atomic Energy Commission].

Images Industrie Systeme offers CCD [charged coupled device] cameras. Systemes Sud markets a microcamera weighing 28 grams and measuring 15 cc, developed by researchers at ENSEEIHT (INPT [National Polytechnic Institute of Toulouse]). Thomson also offers CCD cameras.

Foreign manufacturers, especially Americans, are present in our country. In 1985 Allen-Bradley bought out Robotronics from MATRA. Automatix (United States), a world leader, is also present in France.

## Other Sensors

The range of sensors on the French market is limited. SOURIAU offers optical fiber systems for grippers or for following the seam. It also supplies an incremental fiber optic angular encoder.

Peruchon has developed a sliding dynamic tactile sensor [palpeur dynamique de glissement]. AKR markets a force sensor with six components developed by CERT. Codechamp offers special encoders for robotics.

Foreign suppliers, such as Polaroid and Massa, are present in the ultrasonic proximity detector market.

## Control, Software and Engineering

These are areas in which France is doing well. Manufacturers are developing their own software and control boxes or equipping themselves from French suppliers. NUM (a Telemecanique subsidiary) supplies ROBONUM control boxes with an ISO literal language, particularly to AFMA-Robots.

ACMA and SCEMI produce their own control boxes and use the LPR and LM languages (developed by IMAG and marketed by ITMI). GIXY Ingenierie Informatique is offering its control box and ROL language to Commercys Soudure. Influx, Robotronics, Merlin Gerin and Cynum Industrie are also offering their processors for robotics applications.

French robotics engineering is also active. For example, GAME Ingenierie (a subsidiary of SGN of the CEA-Industrie group) has designed robotized work cells for the nuclear industry and automated cutter lines for the glass industry. It is planning to distribute robots for GMF (United States) in the automotive, nuclear and armaments sectors. Other engineering companies are active in robotics: Cybernetix, established in 1985 by Technicatome (29 percent), SDRM (10 percent), COMEX (26 percent) and IRIAM (8 percent), which is the result of a joint effort by COMEX, Automatique Industrielle, SYSPRO, Midi-Robots, etc.

Simulation products are offered by Simulog and Dassault Systemes. In cooperation with the Laboratoire d'Automatique of Montpellier, the latter developed a robotic module for its famous CAD/CAM software: CATIA [interactive 3D computer-assisted design] on IBM hardware.

25060/8309  
CSO: 3698/A228

## BRIEFS

AACHEN LASER TECHNOLOGY CENTER--The federal government of NRW (North Rhine Westfalia) has recently agreed to purchase a new high performance laser which is supposed to prepare the ground for new processing and manufacturing techniques for steel, non-ferrous metals, ceramics, and composite materials. This ultramodern equipment, which according to the experts will open up completely new manufacturing processes, will have an output power of 22 kW and will be installed in the laser center of the Institute for Manufacturing and Laser Technology of the Fraunhofer Society in Aachen. The existing equipment at the Aachen laser center only has an output power of 5 kW. [Text] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 455, 13 May 87 p 9] 8617

CSO: 3698/M290

## THOMSON CEO GOMEZ ON STRATEGY AFTER SGS SEMICONDUCTOR DEAL

## New Firm Formed

Paris LE MONDE in French 30 Apr 87 p 1

[Article by F.V.: "Birth of the Second European Chip Group: The Franco-Italian Semiconductor Alliance"; first paragraph is LE MONDE introduction]

[Text] The nationalized Thomson group will merge its electronic components business with the state-owned Italian company, SGS. The joint venture will become the second in Europe in this strategic sector. Thomson also announced greatly improved results for 1986 (Fr1.8 billion). Mr Alain Gomez, the company's chief executive officer, explains his overall strategy in an interview with LE MONDE.

The French Thomson group will merge its nonmilitary semiconductor activities with those of the Italian company, SGS. This operation between two "national champions," both state-owned, has just received the green light from the French and Italian governments. The result will be a new company, organized under Dutch law, that will climb into 2d place in Europe, and into 12th place worldwide, in the strategic semiconductor sector, which forms the heart of the electronic, computer, and telecommunications industries.

While the semiconductor war rages between the United States and Japan, Thomson is changing its strategy. After paddling its canoe alone, it has now hooked up with an[other] European. In an interview granted to LE MONDE, Mr Alain Gomez rejects any thought of pulling out. For him, the new, and equal, European partnership will make it possible to reach--in less time, at lower cost, and with less risk--the critical size (estimated at 3 percent of the world market) needed to finance the enormous research and development costs required if one is to stay in the world technological race.

In the face of the enduring crisis in the semiconductor market (marked by excess world capacity for more than 2 years now), nearly all manufacturers are losing money. Thomson and SGS therefore gave another turn to the discussions they had been pursuing since last fall. From a search for crossover subcontracting agreements, the new partners moved on to the idea of a merger. The two firms are quite complementary in their products and markets.

Mr Henri Starck, chief executive officer of Thomson-CSF, will serve as president of the new firm. His CEO will be the current head of SGS, Mr Pasquale Pistorio. They are taking the reins at a particularly difficult moment. In order to counter the influx of Japanese chips into the United States, the Americans have taken unprecedented retaliatory measures and are preparing to provide massive research support for U.S. manufacturers. How to prevent Europe from being invaded by ricocheting Japanese semiconductors? How to fight the rising technological level of American manufacturers? Philips and Siemens have joined together in a joint research program. The Italians and the French will now join forces.

#### Interview with Gomez

Paris LE MONDE in French 30 Apr 87 p 26

[Interview with Thomson CEO Alain Gomez by Eric Le Boucher and Francoise Vayasse: "'Alliance is Not Disinvestment,' Thomson CEO Alain Gomez Told Us"]

[Text] The nationalized Thomson group continued to improve its performance in 1986, showing revenue of Fr62.65 billion (compared to Fr59.88 billion in 1985) and consolidated earnings of Fr1,816 million (compared to Fr583 million in 1985). The performance of its largest subsidiary, Thomson-CSF, was also up, with consolidated revenue of Fr36.05 billion (against Fr32,609 million the year before) and net earnings of Fr2,185 million (Fr960 million in 1985).

Mr Alain Gomez explained his strategy for us and responded to questions covering all of Thomson's sectors of activity: components, defense electronics, consumer electronics, etc. To become big enough, alliances are sometimes necessary, but for Thomson's CEO, alliance is not a synonym for disinvestment.

[LE MONDE] You have just signed a component agreement with Italy's SGS. The CGT is talking about disengagement since you control only 50 percent of the new entity. What is the nature of the operation?

[Gomez] The agreement with Italy's SGS involves an equal alliance. This year, we will reach the objectives that we had set for 1990, namely gaining at least 3 percent of the world semiconductor market, but gaining it faster, cheaper, and with less risk. That is not disengagement; it is pursuit of the strategy by other means.

[Question] How does one control a group with equal shareholders? Who will manage it?

[Answer] We would pass up a good great many European opportunities if we did not accept the 50/50 formula, however inconvenient it may be. In this specific case, the semiconductor activities of STET--SGS's parent company--and of Thomson are exactly the same size. So there is no reason why one company should take precedence over the other.

The disadvantages of such an arrangement will have to be taken increasingly into consideration in European mergers because that is often how matters

present themselves. Furthermore, in this particular case, the disadvantages are much less than those Thomson would incur in continuing to go it alone.

[Question] Thomson finished its recovery in 1986. Nevertheless, the competition continues to sharpen in every one of your areas, and there is frequent talk of selling off the consumer or medical divisions. What is the group's future?

[Answer] Indeed 1986 marked the end of the turn-around phase. Although it has not yet reached the objective we set, profitability is much improved, as Thomson-CSF, which is two-thirds of the group, shows, Thomson-CSF was in a net negative position of Fr246 million in 1983 and ended the 1986 year with a net positive of on the order of Fr10 billion. The subsidiary that lost approximately Fr2 billion in 1982 earned more than Fr2 billion in 1986.

That is the basis upon which the new phase of the group's redeployment can be built. Since 1982, we have sold a number of divisions: nonmilitary telecommunications, lamps, pumps, connectors, ceramics, and leasing, representing a total of Fr15 billion in revenue. The group is still among the largest in world electronics, and, except for Philips, occupies the most sectors for its size. But we have a core portfolio of sectors consisting of defense electronics, consumer goods, components, medical equipment, and financial services, the composition of which seems to me satisfactory at the present time. The relative weakness of some of the divisions is balanced by the good fit among all of them. With the exception of several peripheral sectors, in which we may possibly divest, we have arrived at a rather good distribution as defined by three criteria: return on investment, customer base (government, consumer), and sales outlets (Europe, Middle East, United States). It is this balance that mitigates the relative insufficiency of each of the sectors. That said, the latter condition must be corrected, and the strategy of the group is, for each of the main sectors, to maintain the position of those that are now among the leaders in their field, and to make leaders of those that do not yet have that status.

#### Finance Complements Industry

[Question] Does that mean that you have no desire to leave any of those sectors?

[Answer] Our strategy does not call for divestment in any of the "core sectors." However, that means that we must both perform and, as a result of that performance, gain market shares. Only where we can. And by forming alliances where we cannot go it alone, alliances which do not spell disinvestment.

[Question] You now list financial services as one of your activities. Do you not feel that industry has suffered as a result of finance?

[Answer] No, I believe that the industry we are in cannot do without finance. Finance complements our role as manufacturers, in the sectors of electronics and defense systems essentially, by furnishing the means by which products can be fit within whole systems in which service considerations--not just financial services, but trading, insurance, compensation--are now basic elements.



[Question] In other words, in order to offer a complete service, one must now be a banker as well?

[Answer] Not a banker. We are not bankers. Financiers. As soon as we recognized that need, we decided to kill two birds with one stone by organizing an indispensable activity as an autonomous sector, making its second, and secondary, purpose that of being a profit center, which it has become.

[Question] Doesn't that rob industry of investment capital?

[Answer] That does not hold true for Thomson at any rate. Not only have we kept increasing our capital investments and our R&D budget, demonstrating that what was given to finance was not taken from manufacturing, but on the contrary, finance has helped improve our results. I absolutely do not believe in that artificial separation, certainly not at Thomson.

[Question] Thomson-CSF is one of the giants of military electronics. Is this the primary focus of the group?

[Answer] There is no primary focus for the group. There are vocations. That is one among others, and it represents 40 percent of our business--the largest share--and we do have a certain responsibility to the nation in this area.

[Question] You have reorganized the Equipment and Systems Division, of which you serve directly as chief. Is this a result of your personal interest in the military area?

[Answer] Absolutely not. It is for two reasons: (1) the sector is vital for Thomson, and for more than just Thomson; (2) it is the sector that is going to be most affected by redistributions of the cards between Europe and the United States. There was no reason why defense electronics should be exempted from the large-scale movements of redistribution, deregulation, and restructuring that successively affected consumer electronics in the seventies, components and telecommunications in the eighties, and now medical equipment, as we are seeing with the Philips-GEC agreement. This great shift has already begun in the United States, with the purchase of RCA by General Electric, the merger of Sperry and Burroughs, and partial divestment by certain groups such as Honeywell. It has reached England, witness GEC's tender offer for Plessey; and Germany, with the purchase of AEG by Daimler-Benz.

This overall phenomenon will spread in Europe, while the traditional markets of French arms manufacturers continue to shrink as a result of the considerable drop in the buying power of the oil-producing countries and of the developing countries. This means that the seas are getting heavier and it is going to be hard to keep the engines stoked. Under conditions like that the captain takes the wheel. In any event, do you know of many companies the size of Thomson-CSF where the president is not also the CEO?

#### Cautious Expansion

[Question] Nevertheless, you have been criticized for placing too much emphasis on defense electronics, which is said to translate into a

"militarization" of the group and to lead to a gradual withdrawal from other areas of electronics.

[Answer] Such a move would not make sense for the group in the present competitive environment. No reasonable manager keeps things in his portfolio forever if they are not deemed capable of reaching a certain level of profitability. If it were shown that by divesting itself of all other activities, the group could become an undisputed world leader in one area, whatever that area might be, then the question might indeed be relevant. But since all that is completely hypothetical, the question does not arise.

[Question] Do you favor a European defense?

[Answer] That is for governments to decide. Personally, I am for it. It would allow European manufacturers like Thomson-CSF to attain, in their domestic markets, the critical mass required for their survival. And in the last analysis it would enable Europe to retain mastery of techniques and technologies without which it would no longer be truly independent. As a manufacturer, I can only tell you that Europe still has the technological and industrial means to defend itself. There is no doubt on that score. But in the longer term...it depends on the restructuring taking place over the next 5 years.

[Question] In consumer electronics, can Thomson's strategy be anything more than defensive?

[Answer] First of all, Thomson's consumer division has recovered its good health. Its operating profit in 1986 was more than double that of 1985, and we foresee continued growth in 1987. Between 1970 and 1985, the value of our sales in constant francs quintupled. Our growth has been phenomenal! To me, our policy is one of expansion, very strong expansion, cautious but in no way defensive.

[Question] And the future?

[Answer] The present and the future are a close continuation of the past I have just outlined. While never deviating from our rule of caution, we will pursue cost-competitiveness, and then proceed like a parrot, i.e., never letting go of the bar below before having a good grip on the bar above. In other words, first work on market shares, then production processes, then [new] technologies, in that order.

The future looks more promising. We are mastering all the consumer-sector technologies, including compact disks. Thus we will cover the entire range, but [only] by producing under conditions comparable to those of our large competitors, i.e., by relocating if need be. Remember that the hourly [labor] cost, including social security and like charges, is 6 francs in Korea, less than 12 francs in Singapore, and on the order of 60 francs in Japan (although this is less clear). We are between 85 and 90 francs in France. You cannot fight with one hand tied behind your back!

[Question] Why does one regularly hear talk of selling 20 percent of Thomson's consumer division to Toshiba?

[Answer] That is not true. We have no such plans for the near future. Integrating Thomson within a more powerful group would make sense only if it were absolutely required in order to ensure technological survival, which is not the case.

[Question] The change in government was accompanied by a change in the policy of assistance [to industry]. What do you think of this?

[Answer] There has been no significant change for Thomson. The question does not lie there. The real problem is that conditions in the French and European environment have never been up to those enjoyed by Japanese firms in their markets. And French public financing resources are not up to American public financing resources. Our American competitors in defense systems and electronics receive 80 percent financing for their research. The rate is presently 50 percent for semiconductors, but the Pentagon is preparing a plan to double that amount of financing each year.

We receive assistance amounting to about 35 percent on defense systems and 50 percent for R&D on components.

The Japanese are now the leaders in semiconductors. This is a replay of what we saw in the seventies for consumer electronics. But this time, the Americans, manufacturers and government alike, are not being taken. The American government has already taken protectionist measures by signing a trade agreement with Japan, and, recently, by adopting retaliatory measures. America is protecting itself.

All of this will raise the technological level of our competitors and shut off the tap of technology transfer from America. Our job in Europe, where we know less and are less able to protect ourselves, has become very difficult. For this reason, and this is true for Thomson in general, we will have to demonstrate extra reserves of drive, lucidity, creativity, and speed.

13221/12859  
CSO: 3698/431

## MHS OF FRANCE OUTLINES 1987 SEMICONDUCTOR STRATEGY

Paris ELECTRONIQUE ACTUALITES in French 16 Jan 87 p 16

[Article: "A 1-Micron CMOS [complementary metal oxide semiconductor] Product Line for MHS [Matra Harris Semiconductor]: MHS Stresses Its Presence in Military and Telecom Sectors in ASIC (Application-Specific Integrated Circuits)"]

[Text] On the occasion of the ceremony granting RAQ 1 certification, MHS has taken stock of its operations and future prospects. Faithful to its policy of internationalizing its market slots, the company has stated that the 1987 program will involve the extension of the distribution network, primarily in the Far East, where the results are already tangible, and new locations for ASIC design centers (St Quentin, Milan, Hong Kong, and Stockholm).

As for ASIC, it will be important starting this year, because the company will offer its services as a founder for 1.2 micron CMOS. In 1988, a 1 micron CMOS product line will be launched, in cooperation with CNET [National Telecommunications Studies Center].

In sum, MHS, which has increased its production by almost 30 percent in volume this year, will have achieved revenue of Fr400 million, primarily in the military and space sectors. MHS is counting on its performance in specific sectors for its future expansion, which is manifested by a policy of market slots, in parallel with worldwide distribution, to assess performance.

For its future developments, MHS is relying on static memory technology, on which the development of other production is based. According to company estimates, 1987 will bring revenues between Fr450 and 500 million as compared to Fr400 million in 1986 and, for the rapid CMOS static memory sector, a market experiencing competition from Japanese production, MHS accounts for approximately 25 percent of the French market (the same quota is found for pre-distributed CMOS networks). The rapid 4-K and 16-K SRAM [static random access memory] appeared this year at about the same time that the agreement with CYPRESS was reached in which its rapid 1.5- and 1.2-micron technologies were transferred (on the industrial and financial side, MHS is providing CYPRESS with silicon chips and owns part of the capital of the American company). Rapid 64 K 25 nanosecond SRAM memory units will be produced in 1987.

MHS, which, within its commercial policy logic, wanted to include complex signal- and image-processing-oriented products in its catalog, manufactures Weitek rapid (16x16) multipliers.

MHS has also been heavily involved in telecommunications and military circuits since its subcontractor agreement with Intel for the 80 C 51 controller (in the CMOS version). In 1987, we will see CMOS 80 C 52 and 83 C 184 microcontroller circuits, as well as in telecommunications circuits, strictly speaking, the second generation Cofidec for 29 C 48 subscriber cards and 1 layer S interface ISDN [Integrated Services Digital Network] 29 C 53 circuits. MHS modems are benefiting from the Minitel program, which requires 800,000 to 900,000 units per year, ordered by the DGT [General Telecommunications Directorate]. As for the military, the demand for 80 C 51 microcontrollers will be increased by participation in the RITA [Integrated Automated Transmission Network] program.

In 1988, there will be a large demand for the ISDN circuits currently under development, which will benefit MHS, as they will be supplying them starting in early 1988.

Finally, MHS cannot ignore the most promising part of the market for its expansion--up to 40 percent annually, according to Dataquest--ASIC.

#### ASIC Design: Recentering in Paris

Next April, with the recentering in Paris (St Quentin), MHS is undertaking a policy of bringing the design center closer to the client in parallel with increasing the number of design centers (in Europe and the United States). Nantes, Paris (100 employees, 10 to 15 MIPS [million instructions per second] capacity as compared to 20 MIPS at Nantes currently), Santa Clara (6 MIPS, 25 employees), Munich, and London have already been opened. In 1987, design centers will open in Milan, Hong Kong and Stockholm. The number of designs, which is currently approximately 400, will increase accordingly.

This move to get closer to the user/client, inherent in this style of marketing, which can be considered first and foremost to be a service market, is manifested by the availability of standard tools from the software chain to the computer-assisted design developed by MHS. In sum, in ASIC, MHS offers predistributed matrices of 250 to 7,500 gates in the 3-micron version; 1 layer of metal and 2 micron, 2 layers of metal.

The availability of foundry operations for 2 micron and soon 1.2 micron silicon constitutes an increase in size for MHS, which will agree to manufacture "sub-lots" of 1 to 5 or 6 wafers with short turnaround times. Thus the circuits they design can be manufactured. On this level, several solutions have been suggested; they can either obtain a user's license for MHS design rules or obtain silicon-compiler software, or, finally, work in MHS centers equipped with Genesil and SDL silicon compilers.

### 1.2 Micron CMOS Product Line

Starting in 1987, MHS will design and manufacture 1.2 micron, in addition to 3 micron and 2 micron, CMOS circuits using lithography and 2 layers of metal; 1.2 micron indicates an 0.8 micron effective transistor channel width. In addition, in agreement with CNET, thus relieved of the contingencies inherent in previous American agreements, starting in 1988, MHS will use a 1 micron CMOS product line. Finally, work on radiation resistance is being carried out on the 2 micron product line and will be pursued in 1988 on the 1.2 micron product line.

Currently, MHS produces the majority of its catalog in 1.5 micron CMOS, 2 layers of metal (effective channel length is 1.2 micron), and the company manufactures 1,000 125-mm wafers per week. The potential capacity is double, 2,000 wafers. As for assembly in France, the total is 6,000 IC's per week.

### An Opening in the Far East

Created in 1986, after the disinvolvement with Harris, the international sales network has not been idle, and has started four commercial subsidiaries in Germany, Italy, Great Britain, and Hong Kong. The latter also has a network of distributors for the Far East, with discounted volume sales; the results for Taiwan are already significant. As for the United States, the only means of penetrating the market has been to rely on the Harris sales network--it holds 45 percent of the capital, whereas Matra holds 55 percent, making it the majority owner--which produces Matra's MDS [Matra Design Semiconductor] product line.

In France, sales are assured by the St Quentin-en-Yvelines commercial department. In sum, MHS has increased the number of units produced by 30 percent in volume in 1986 as compared to 1985. The statistical breakdown of sales for France and Europe is as follows: Telecom 35 percent and 25 percent; information technology 27 percent and 25 percent; industrial 8 percent and 10 percent; distribution 15 percent and 23 percent. Currently the military sector is undergoing the greatest increase.

13146/6091

CSO: 3698/290

## SPAIN: FUJITSU MARKETS 'K', 'SENDA' SERIES OF COMPUTERS

Paris AFP SCIENCES in French 5 Mar 87 p 36

[Article: "Fujitsu Spain Introduces Two Computer Series to the Spanish Market"]

[Text] Madrid--On 3 March the Spanish subsidiary of the Japanese data processing and computer giant Fujitsu announced the official introduction of the first two computer series manufactured in Spain for the Spanish market: the "K" and "Senda" series.

"This will be the year of Fujitsu's introduction to Spain," declared Mr Chiaki Sugishima, vice-president and representative of Fujitsu Espana (FESA), at the end of January, in announcing the impending marketing of a new product on the markets of the peninsula.

The Senda computer series, for which the language is Spanish, was completely designed and produced in Spain by Spanish engineers. According to the data sheet, the Senda computer series can accommodate 1-8 work stations, and operates with a 16-bit (80186) microprocessor at 8 MHz. The Senda series (Senda 20-1 and 20-2) offers the following characteristics, taking into account all the proposed peripherals: a central 1 Mb memory, 128 Kb ROM, 12 asynchronous lines and 2 lines for modems, a 1 Mb 5 1/4-inch floppy disk drive, and four 25 (for 100 Mb) or 43 Mb (for 172 Mb) Winchester-type drives.

According to Mr Juan Jose Guillen, commercial director for Fujitsu Espana, the computers of the "Senda" series are primarily designed for small and medium size businesses. The "K" series computers, he stated, are specifically designed for government and large businesses.

The "K" series computers, which were first developed in Japan, use COBOL (level 81) and FORTRAN as operating and development languages. Their primary technical characteristics are: 32-bit architecture, 20,000 gate VLSI, and 2 and 4 Mb memory boards. The computers in this series come with a 15 Mb memory, and 6.6 gigabits of disk memory. They can accommodate up to 112 work stations (screens, printers, personal computers, etc.) and 32 communication lines with an overall efficiency of 384 Kbps.

The two series are currently undergoing final quality control testing and the "Senda" and "K" series should be available in April and May respectively, stated the FESA representative.

Mr Sugishima also stated that the FESA R&D center at Malaga (Andalusia) will be completed at the end of 1987. The FESA research sector, presently divided between Madrid and Barcelona, currently employs approximately 200 engineers. Mr Sugishima also stated, without providing further details, that one of the current goals of Fujitsu Espana is to increase its export activity.

13146

CSO: 3698/410



## BRIEFS

THOMSON-SGS 0.8 MICRON SEMICONDUCTORS--Paris--The EC ministers have approved the first phase of the project for the joint development of 4- and 16-Mbit memories proposed by the Italian SGS [General Semiconductor Company] and the French Thomson Semiconducteurs companies (see ELECTRONIQUE ACTUALITES 5 December 1986). This project, which will extend over a period of 5 years, concerns the development of a 4-megabit EPROM [erasable programmable read only memory] memory using 0.8 micron CMOS technology. It should also demonstrate the possibility of subsequently achieving a 16-megabit EPROM memory using 0.5 micron CMOS technology. The estimated cost is 200 million ECU for each of the partners. There is currently no comparable European program for this type of memory. Thomson Semiconducteurs and SGS are the only European manufacturers of EPROM memories in a worldwide market which was \$850 million in 1985 and was dominated by Japanese and American manufacturers. The manufacturers have at their disposal the most complex 256 Kbit memories; 512 Kbits are used for the following applications: information technology (45 percent), telecommunications (38 percent), industrial (9 percent) and military (8 percent). Thomson Semiconducteurs has a 1-Mbit memory in the preproduction stage. The SGS/Thomson Semiconducteurs project represents the pooling of considerable financial and intellectual resources for a coordinated research and development effort which will strengthen the European position in non-volatile memories, which are present in many applications (computers, consumer electronics, defense systems, etc.). This market will represent approximately \$3 billion in 1990. [Text] [Paris ELECTRONIQUE ACTUALITES in French 9 Jan 87 p 14] 13146/6091

FRENCH SUPERCONDUCTIVITY BREAKTHROUGH-- Paris--A group of French researchers from the CRIMSAT LAB of the Materials and Radiation Sciences Institute at Caen have made an important breakthrough in the superconductivity field by identifying a material that behaves as a superconductor at minus 182 degrees Celsius, instead of -273 which is absolute zero. "Under the circumstances, this is the very first time--according to a statement made to the French press agency AFP by Bernard Ravaud, one of the authors of a memo released on the subject to the Academy of Sciences on March 16--since all the news about new superconductor materials started coming out of various labs around the world at the end of December that anyone has been able to identify the precise nature and chemical formula of the material." It is in fact a metallic oxide of copper, yttrium, and barium, with chemical formulas  $Ba_2$ ,  $YCu_3$ , and  $O_8$ . The Caen group, in association with the CNRS Very Low Temperatures Research Lab in Grenoble, was able to pinpoint the correct phase, that is, "a precise chemical composition in conjunction with a specific

configuration of atoms in space, in other words an identifiable crystalline structure. Knowing the exact formula makes it possible to understand what is happening and to recreate the experiment, i.e., to manufacture this material which acts as a superconductor throughout its entire mass," Mr Ravaud emphasized. [Excerpt] [Paris AFP Sciences in French 19 Mar 87 p 46] 13307/13046

PECHINEY: NEW CERAMIC POWDERS--Paris--On 20 May, Pechiney announced that Criceram (Pechiney group) has developed a new process to synthesize barium titanate and strontium titanate for ceramics that are used in the electronic industry. The products they obtain have a perfectly controlled granulometry and purity. They should significantly improve the performance of ceramic components with a high dielectric constant, such as multilayer condensers. Criceram is one of the world's leading producers of powders for technical ceramics (ultrapure zirconia and alumina). It exports 80 percent of its production, Pechiney declares. [Unsigned article] [Text] [Paris AFP SCIENCES in French 27 May 87 p 26] 11,023

CSO: 3698/582

## BRIEFS

BMFT AMENDS SUBSIDY GUIDELINES--The amount of the grants published in the "Guidelines for the Promotion of Research Cooperation Between Industry and Science," (FEDERAL GAZETTE 23 June - issue 1 July 1986, item 5.1, p 8112) has been modified as follows: for the first-year employment of a junior researcher, DM33,750; for the second year, DM30,000; and for the third year, DM26,250. These amounts will apply until further notice to grants awarded as of 1 May 1987, by order of Dr Bechte, on behalf of the Federal Minister of Research and Technology. [Summary] [Bonn TECHNOLOGIE NACHRICHTEN-MANAGEMENT INFORMATIONEN in German No 456, 27 May 87 p 8] 8703

CSO: 3698/M316

## POLISH PARTICIPATION IN SPACE PROJECTS

## Cooperation in Solar Research

Warsaw ASTRONAUTYKA in Polish No 2, 1987 pp 2-3

[Interview with Dr Janusz Sylwester, director, Solar Physics Division, Space Research Center, Polish Academy of Sciences, Wroclaw, by Andrzej Markert, date and place not given: "Poland's Contribution to International Solar Physics Research"]

[Text] In the very near future the previously calm sun will begin its entry into a period of increased activity within an 11-year cycle, reaching the maximum in 1990-1992. Interkosmos is preparing a broad program of international solar research during the maximum activity period, and Poland will also participate in the program. The program calls for launching of two satellites for solar research, Koronas, to permit observation of our star outside the atmosphere. In addition to taking part in the Interkosmos project, Poland will conduct solar physics research of its own in cooperation with scientific centers in various countries.

What is the Polish solar physics research program like? "We are designing several Polish research experiments involving use of Polish-made equipment," says the director of the Solar Physics Division of the Polish Academy of Sciences Space Research Center in Wroclaw, Dr Janusz Sylwester. "They will be satellite experiments. We are cooperating with Czechoslovakia to develop an instrument called Diogenes for solar flare research for the international solar research satellite."

The Diogenes will be used to analyze the processes of emission and transport of energy in solar flares. Enormous amounts of energy are released in explosions on the Sun. We want to determine how this energy is released and how it is converted from one form to another. Scientists have been puzzling in vain for more than 100 years over solution to this problem in solar physics. Energy occurs first in the form of magnetic fields visible as spots on the Sun which at times reach the dimensions of the diameter of Earth. These fields interact to yield large amounts of energy which is converted from magnetic to thermal. Plasma is heated to 30 million degrees Celsius, twice as high as in the center of the Sun. The accelerated streams of particles reach Earth, causing magnetic storms. Thanks to Diogenes, it will be possible to

measure the movement of burning plasma during solar flares with an accuracy of 1 to 3 kilometers per second. Poland is producing the spectrometer itself for this instrument, and Czechoslovakia is developing the soft and hard X-ray detectors. The possibility also exists of developing a highly sensitive spectrometer in cooperation with Czechoslovakia and Great Britain to record the X-ray spectrum. This equipment will be used to study the early stages of solar flares.

[Question] The solar research program using the Koronas satellites promises to be interesting. Do we plan to participate in other satellite experiments in addition to this one?

[Answer] Polish specialists are working on the elements of a photometer to measure the Sun's X-rays. We are developing this instrument, designated RF.15I, in cooperation with the Institute of Astronomy of the Czechoslovak Academy of Sciences in Ondrejov for the international satellite program Interbol.

[Question] What does this program consist of?

[Answer] It will consist of research on outer space near Earth, conducted simultaneously by two satellites. One study will be in the area of the aurora polaris, and the other in that of the magnetic fire of Earth.

[Question] And what is the Polish share of this research?

[Answer] We are developing an instrument for a satellite whose orbit will extend through the magnetic fire of Earth. The purpose of this instrument will be observation of changes in the stream of solar X-rays.

This radiation arises in the solar corona, in areas in which the plasma temperature exceeds 2 million degrees Celsius. It has an effect on the upper layer of the atmosphere, the ionosphere. The Polish-Czechoslovak instrument permits analysis of X-radiation in a narrow sector of the Sun's surface. It will be characterized by high resolution, around 10 seconds of arc. Consequently, it will be able to observe X-ray structures measuring around 10,000 kilometers. They are very small ones in the Sun as a whole, which has a diameter of 1.4 million kilometers.

[Question] Koronas and Interbol are plans for the future. What is currently taking place in solar physics research at Wroclaw?

[Answer] We are engaged in a large number of interesting projects. Mention should be made of the research on phenomena taking place on the Sun which we are conducting in cooperation with the famous British Mullard Laboratory in London. The Polish-British cooperation covers analysis of solar spectra recorded by means of the SMM (Solar Maximum Mission) satellite. This satellite, which was designed for solar research and which has been in outer space for several years now, was recently repaired in orbit by the crew of the American space shuttle.

The emission lines recorded by the SMM satellite, which are emitted by hot plasma in flares on the Sun's surface, provide information about many active processes taking place on the Sun. Spectral analysis makes it possible, among other things, to determine the temperature and amount of solar plasma. The cooperation between Polish and British solar physicists, which has been underway for several years now, recently yielded an interesting discovery throwing new light on the phenomena occurring on the Sun. It has been found from analysis of the solar spectrum that the chemical composition of plasma changes in a flare. It has been found that solar plasma is enriched with calcium in flares.

It is also worth noting the cooperation with Czechoslovakia in interpreting an analysis of the solar X-ray spectrum. We are analyzing the data recorded by the Czech equipment installed on the Soviet Prognoz geophysical satellites.

[Question] Some years ago there was much talk about Polish experiments in international solar research conducted with Soviet Vertikal' geophysical rockets. Is this work still in progress?

[Answer] Vertikal' 11 completed a cycle of rocket experiments in 1983. Polish equipment for X-ray studies of the Sun was carried by the Vertikal' I, Vertikal' 2, Vertikal' 5, Vertikal' 8, Vertikal' 9, and Vertikal' 11 rockets. Our research has yielded many new data on the X-ray emission of the Sun. The rocket experiments made it possible to develop new research methods, prepare technologies, and carry out practical testing of scientific apparatus. As a result, we are able to produce more efficient equipment for satellites. Satellite research even now represents a more advanced stage of solar physics studies in outer space.

#### Satellite Television

Warsaw ASTRONAUTYKA in Polish No 2, 1987 pp 4-6

[Article by Magda Sowinska based on interview with Docent Janusz Zugierewicz, Communications Institute: "Satellite Television in Poland in the Light of Communications Institute Research"]

[Text] Satellite television systems have the following advantages over ground systems: the possibility of simultaneous transmission of several programs over the territory of the country from a single satellite plus virtually identical received signal strength and only slight variation in a received signal over time, along with high reception quality anywhere in the country; the possibility of introducing improved television standards and new kinds of television services; the possibility of replacing the network of several ground transmitters connected by transmission lines with equipment installed on a single satellite; and the possibility of using standby transmitters or even entire standby satellites, thereby ensuring trouble-free operation of the system.

Signals from a radio broadcasting satellite can be received on an individual basis (each television subscriber is provided with suitable receiving equipment) or on a collective basis (the signal is received by means of a

single device for an entire building or group of buildings and is transmitted to individual residences by a cable system).

Satellite radio broadcasting is most interested in utilization of the frequency range around 12 gigahertz because of the slight use of this range by ground radio services, the great width of the available frequency band, the ease of concentrating waves in a narrow beam, and the possibility of achieving high selectivity in spatial reception along with small antenna size. Precisely the problems of settling the principles of using this frequency range were dealt with by the World Administrative Radio Communications Conference on Satellite Radio Broadcasting Matters held at Geneva in 1977. The work of the conference resulted in the drawing up of a plan for use of a geostationary orbit by radio broadcasting satellites and of the 11.7-12.2 gigahertz (Region 3) and 11.7-12.5 gigahertz (Region 1) frequency ranges, which cover Europe, Africa, and the Asian portion of the USSR.

In keeping with the decision of this conference, Poland acquired the potential for transmitting five television programs over five radio channels (1, 5, 9, 13, and 17) in the frequency range around 11.7 to 12.00 gigahertz, from a satellite in geostationary orbit in a nominal position of 1 degree West longitude (above the Gulf of Guinea). The nominal position of the satellite coincides with that of other socialist countries (GDR, Czechoslovakia, Hungary, Romania, USSR). This creates the possibility of using joint satellites and protects against the location of satellites of other countries in this position.

The satellite-borne transmitter power of around 100 watts per radio channel and the angular field of 15 degrees by 0.6 degree of the satellite antenna beam ensure the possibility of individual and collective high-quality reception of black-and-white and color television programs throughout Poland every day at least up to 0020 hours (this limitation is imposed by the so-called eclipse of the satellite by Earth in autumn and spring disabling the satellite's solar batteries). The elevation angles of the ground reception stations range from around 24 degrees (in the Suwalki area) to around 30 degrees (in the Zakopane area), and the azimuth angles from around 198 degrees (in the Swinoujscie area) to around 211 degrees (in the Bieszczady area).

Since the authorities were aware of the importance of the satellite broadcasting system, in 1972 a research project on the principles of development of a satellite broadcasting system was added to the Interkosmos program, and Poland was assigned the mission of coordinating this project. The progress made is indicated by the fact that the subject of the project was specified in 1978, it being development of a satellite television system in the 12-gigahertz frequency range and preparations for commencement of experimental operation of the system. The final version of this project was coordinated in 1986, and in June 1986 the requirements to be set for the system were confirmed at a meeting of the Permanent Working Group for Space Communications.

As part of the work done on this project, a stage-by-stage plan for completion of the system was drawn up, calling initially for placing a common satellite for several countries in orbit. This satellite is to transmit a single program to each of the countries. Broadcasting will probably begin in 1990.

With the cooperation of the Industrial Telecommunications Institute, the Communications Institute has developed satellite television reception equipment designed to operate in conjunction with an antenna installation ultimately permitting direct reception of television signals over the five radio channels set aside for the needs of Poland.

The equipment designed at the Communications Institute is a multiple-channel receiver with twofold frequency conversion and change of modulation mode plus shifting of signals from the frequency range around 12 gigahertz to the frequencies of the corresponding channels in the standard television ranges. From the viewpoint of functional design, the equipment can be divided into two components, a microwave unit and a satellite radio broadcasting signal conversion unit. The first unit was developed by the Industrial Telecommunications Institute and the second by the radio communications division of the Communications Institute.

The microwave unit, which is designed and adapted for installation on the roof of a building, includes a parabolic antenna having a diameter of around 1.5 meters, a system for converting the circular polarization of the electromagnetic wave received to linear polarization, microwave filters, a frequency conversion system, and a first intermediate frequency amplifier.

The satellite radio broadcasting signal conversion unit can be connected to the antenna terminal by means of a concentric cable and is installed inside a building near collective antenna installation equipment of various kinds. From the structural viewpoint this unit houses 12 cassettes. The first cassette contains the first intermediate-frequency amplifier and a circuit branching the signals received into five lines. It is followed by five units for individual satellite channels. Each channel unit contains two cassettes. The last cassette contains a circuit for summation of the signals from the five television channels, plus a circuit for adaptation to the collective antenna installation equipment, operating condition signal circuits, and individual equipment unit amplification circuits.

The entire receiving equipment system has been tested under laboratory conditions. A so-called satellite simulator is required for local testing of the entire set of receiving equipment. Work is in progress at the Communications Institute on such equipment. After this work is completed, it will be possible to begin comprehensive testing to allow verification of the technical solutions employed and introduction of any changes needed with the aim of optimizing the circuits of the reception equipment.

Research of a very promising nature is currently in progress in addition to these projects under the Interkosmos program. For example, the use of an analog frequency modulation system for both the video and the audio signals has been organized in previous studies. To improve transmission conditions and quality, the Communications Institute has started work on a hybrid analog-



digital modulation method similar to the MAC-PAL system but adapted to the SECAM system.

Poland has a vital interest in use of radio broadcasting satellites. The ground television systems in the meter and decimeter wave range are currently being expanded for the broadcasting of programs over two channels. The building of a network for broadcasting programs over a third channel is also planned. It will be necessary for this purpose to build or expand several dozen transmitting facilities, build approximately 9,000 kilometers of radio lines, and install an additional several hundred television converters. This entails heavy expense, and further increase in the number of television programs transmitted will in effect be possible only by using satellite broadcasting systems, because of the lack of free channels in the meter and decimeter wave ranges. This justifies active Polish commitment to the development of these systems. Following the initial experimental research period, it is anticipated that satellites (or parts of their radio channels) will be leased for the needs of the domestic satellite television system, and Poland will build a ground station of its own to transmit programs to a satellite and will begin mass production of receiving equipment. However, this will require major organizational and technical efforts entailing heavy financial outlays. Only availability and widespread use of a satellite television system in Poland will show that the work now being done on this system at the Communications Institute has been successful.

#### Equipment for MIR Station

Warsaw ASTRONAUTYKA in Polish No 2, 1987 p 11

[Article by AM: "Polish Equipment for the MIR Space Station"]

[Text] The Space Research Center of the Polish Academy of Sciences is developing elements for the remote detection equipment to be installed in the Soviet MIR orbital station. One such element will be a set of cameras operating in various regions of the spectrum, including the visible and infrared bands. Poland is cooperating with Czechoslovakia on development of a camera operating in the visible band. It will be a camera of a new type based on transistorized circuits. Cameras of a similar design have already been used in the Vega space probe to study Halley's Comet. Czechoslovak specialists are producing the detectors, while the entire electronic system is being developed in Poland at the Space Research Center of the Polish Academy of Sciences. The Polish-Czechoslovak camera is expected to be installed in the MIR orbital station around 1990.

The MIR station will be gradually expanded by attachment of replaceable segments containing specialized scientific apparatus. The plans also call for a segment designed for remote detection. This will allow broad expansion of the Przyroda [Nature] research program, which will institute permanent monitoring of Earth's natural environment. Poland will also participate in this project.

6115

CSO: 2602/28

## INFOSYSTEM 87 COMPUTER EXHIBIT IN POLAND

Prague SDELOVACI TECHNIKA in Czech No 5, May 87 inside back cover

[Text] On the occasion of its 120th birthday the Polish magazine PRZEGLAD TECHNICZNY sponsored the Infosystem '87 international exhibition of computer equipment held in Wroclaw. It was an extensive exhibition with 96 booths on 3,500 square meters and it enjoyed great interest on the part of the Polish public and foreign guests as well. We will devote our reporting to booth number 1, that of Elwro, the Wroclaw Electronics Plant, which has produced digital computers for a number of years now. The JSEP-EC 1034 computer is one of its newest products. Its architecture, design and technological solutions, and operating parameters represent marked progress as compared with previous computers manufactured by these plants. In comparison with the EC 1032 computer manufactured previously, the computing speed has been increased by more than 40 percent, the maximum size of the memory has grown to 64 MB (with the EC 1032 the maximum memory capacity is 2 MB), and the number of channels for input and output is twice as large with almost twice as much overall throughput capability. The EC 1034 computer is equipped with everything necessary for working with a computer with virtual memory. The modern features of the EC 1034 computer are apparent in the equipment's small dimensions, a more than 5-fold decrease in the power required, and a more than 10-fold increase in the time between outages. The EC 1034 computer system is a general-purpose computer belonging to the third generation JSEP computers (RJAD-3). The EC 1034 system is fully compatible in terms of programming with the other members of the JSEP 3 series--the EC 1027, EC 1036, EC 1046, EC 1056, and EC 1066--and likewise with all the JSEP 1 and JSEP 2 computers, the IBM 360, IBM 370, and IBM 303X. The central unit of the EC 1034 computer, designated the EC 2134, fully conforms to the JSEP 2 operating conditions and performs the majority of the functions assigned to JSEP 3 computer operations. Thanks to its high level of productivity in performing calculations and its large capacity of operational memory, the EC 2134 can serve as the base for quite large computer systems. It is also possible to create systems based on the EC 2134 which provide remote access to data sources. Existing resources make it possible to create systems with a number of computers. This ensures an increase in the functional reliability of the system and flexible management of the load on the individual computers.

The EC 8371.01 PTD communications processor is a programmable unit controlling the operations in the network of data transmission equipment. It fulfills the

role of the main equipment of the remote processing systems. This is a piece of equipment which controls and monitors the course of transmissions and two-way communications between computers and terminals while at the same time taking over from the computer a number of operations connected with transmission support. The PTD can interface through a standard port with JSEP computers, which work in the OS/JS operating system. The PTD interfaces with the individual terminal work stations by means of communications links. One of two control programs (EP or NCP) which is stored in the PTD operational memory provides for implementation of the individual PTD functions. The basic characteristic of the PTD is its modular nature. It is made up of the following sections: the control unit - JS, the channel adaptor - AK, the operational memory - PA0, the communications switch - SK, the service section with groundline adaptors - B0, and power - ZZ. The PTD software is closely connected to the computer operating system, which makes use of the PTD services. This is a consequence of the conditions connected with the methods of the communications procedure contained in the appropriate operating system. The effectiveness of the work of a terminal system formed on the basis of the PTD is determined to a great extent not only by the PTD control program, but also by the computer operating system.

The Elwro 800 microcomputer represents the most advanced model in the series of microcomputers manufactured in the Elwro plants. It is built on the basis of an 8-bit or 16-bit processor, which makes it possible to create multi-processor systems as well. Besides this basic feature, its greatest advantage is also its modular nature in creating systems. Individual groupings can be formed from the modules of the 16-bit microcomputer, the 8-bit microcomputer, the smart floppy disk controller, the 256 KB RAM memory, and the monitor and keyboard controller. Other modules are being prepared and will be available during 1987 and 1988 such as the Winchester-type disk controller, the color graphics monitor controller, the controller of the local net in accordance with the Ethernet standards, and the controller of the communications links in accordance with BSC, SDLC, and HDLC protocols. The Elwro 800 microcomputer software is likewise quite extensive. Of the operating systems, there are CP 08 (disk operating system for an 8-bit microprocessor compatible with the CP/M system), CP 16 (a similar system for a 16-bit microprocessor compatible with CP/M 86), and ISO 8 (disk operating system for an 8-bit microprocessor compatible with the Isis-II system). The auxiliary programs include the 8080/8085 and 8086/8087 macroassemblers; the Pascal, PL/M, Fortran, and Basic language compilers, the Basic language translator; monitor editors; and text processors.

Figure 4 (not reproduced) shows the Elwro 800 Junior, a microcomputer designed mainly for the needs of training in education. Its ROM permanent memory is 24 KB and the RAM operational memory is 64 KB. The Junior 800 model also has a modular structure and the following modules are available: the central unit; color graphics; sound generator; local computer network unit; floppy disk control unit; cassette tape memory; input and output circuits with a capability of connecting printers, including graphics outputs; joystick; light pen; and mouse. It is equipped with a Basic translator and is compatible with the Sinclair Spectrum computer and others. It works with the CP 08 operating system or in some cases with CP/M 2.2.

## CHEAPER PPCS TO BE AVAILABLE IN HUNGARY

[Editorial Report] The Budapest economic weekly FIGYELO in Hungarian 11 Jun 87 p 6 and COMPUTERWORLD/SZAMITASTECHNIKA in Hungarian 24 Jun p 1 comment on the situation in regard to cheaper PPCs [Professional Personal Computers]. The five Hungarian firms which won the competition for producing cheaper PPCs are to be awarded support in the amount of 5 million dollars, according to FIGYELO. The decision was announced in January 1987 when it was agreed that the money is to be spent on importing computer components and parts for production of 4,000 PPCs to be sold at a maximum price 45-55 percent lower than 1986 prices. support, says FIGYELO. The director of the Elektromodul Foreign Trade Enterprise is quoted as maintaining that the authorities have no source from which the money can be taken at present. The only producer of the cheaper PPCs according to COMPUTERWORLD/SZAMITASTECHNIKA is the Videoton Computer Factory. Although it has received none of the price money, it has already begun to deliver and will meet all orders received by 30 June. Videoton guarantees that prices agreed upon in the competition will be honored throughout the year regardless of whether the computer is part of the subsidized series of 1,200 machines.

Despite the delay in allocation of supports the "other winners of the competition are optimistic now." This is because, as a counsellor of the Ministry of Foreign Trade told COMPUTERWORLD/SZAMITASTECHNIKA, a solution acceptable to all concerned has been reached. Details are now being worked out. It is "certain" that one thousand plus forint XTs and two thousand forint plus ATs will go on the market during the current half year.

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CSO: 2502/0081

## POLAND: ACTIVITIES OF MERCOMP R &amp; D CENTER

Warsaw PRZEGLAD TECHNICZNY in Polish No 50, 14 Dec 86 p 20

[Article by W. G.: "A Limited Liability Company"]

[Text] I should like to introduce you to a firm which is representative, from the viewpoint both of activities in the area of innovation and practical application and of form of ownership, of the trends preferred both by the Committee on Questions of Science and Technical Progress (KniPT) and by other government organizations which organize the economic life of Poland (Secretariat of the Commission on Economic Reform Matters, the Planning Commission under the Council of Ministers, the Ministry of Finance, etc). Also from the viewpoint of the law on innovation units discussed here, this company is an example, I believe, of the solution preferred in the area of accelerated technical progress.

I am referring to the MERCOMP Research and Development Center, a limited liability company or corporation established in 1984 as a result of an agreement reached between its current stockholders. The initial capital of this company was 200 million zlotys. This means that the financial responsibility of MERCOMP is limited to this amount. Its stockholders are enterprises, educational establishments, and social institutions and organizations. They include plants such as the MERA-PNEFAL Industrial Automation Enterprise, the ELEKTROMONTAZ Construction Electric Equipment Production and Installation Enterprise, the MERA-STER Control System Scientific Production Center, and also higher schools and organizations of high social utility such as the Chief Technical Organization. Accordingly, it is a company of stockholders each of which is nevertheless in the socialist sector of the economy. I believe that the proposed law on innovation units gives preference to solutions of this type in its solutions.

What does MERCOMP concern itself with? To put it briefly and in public relations terms, it should be said that MERCOMP concentrates on research, development, and practical industrial application of new technical ideas, technological concepts, patents, and so forth. It concerns itself with creation and assembly of microcomputer systems for industrial automation units oriented toward control of continuous production processes. Another parallel direction of MERCOMP specialization is represented by conventional measurement and automation systems based on well-tested and trouble-free measurement and control equipment made by the stockholder firms referred to above. It should be added by way of explanation that MERCOMP markets a full range of services covering the stage of design of circuits and computer software for control

with the West German stock company SIEMENS (Siemens Aktiengesellschaft) the TELEPERM-M system, a current Siemens commercial breakthrough. It is a computer system for decentralized control, monitoring, and regulation of industrial processes. Its greatest advantages are firstly decentralization of a computer-controlled system, and secondly its versatility, in that it can be applied both in fuel-intensive industries such as dairy farming or papermaking and in large, small, and medium-sized plants. This structural flexibility of the TELEPERM-M system also ensures its price flexibility (from several tens of thousands to several million marks, depending on the level of complexity of the system in which the TELEPERM-M system is to operate).

I believe that MERCOMP's development prospects lie in openness to the outside world. The specialists and experts employed by the company include people with much experience who have worked on major industrial investment projects in a number of countries (Bulgaria, Czechoslovakia, India, Iraq, GDR, FRG, Italy, Morocco, Iran). Broad international cooperation in a variety of forms, from procurement and marketing through barter transactions to cooperation in industrial production and joint action on third-party markets, is a direction holding promise of development. I believe that this applies to all ventures undertaken in the area of innovation. The current situation in the world of technology is simpler than it might appear. Technical progress today is rather a matter of improving already extant solutions than of finding new ones, and if this is the case it is necessary above all to create conditions setting initiative free, conditions opening up access to solutions, and lastly conditions freeing up the financial resources both of individuals, groups, and institutions.

The MERCOMP Research and Development Center has been in operation for only a short time, barely 2 years. Reports show that over this brief period this company has accomplished a maximum turnover of the order of a billion zlotys. This obviously is not a mountain of money, but surely it proves the tangible existence of demand for a different new form of commitment of capital and for organization of this capital in a rational and responsible manner. If the proposed law on innovation units becomes a step in this direction, we will be able to say that the columns we have devoted to publicizing this form of investment will not have been in vain.

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CSO: 2602/17

## EXODUS OF POLISH ELECTRONICS SPECIALISTS DEPLORED

Warsaw PRZEGLAD TECHNICZNY in Poland No 3, 18 Jan 87 pp 10-11

[Interview with Dr Wojciech Nowakowski, director, Instruction Division, Institute of Principles of Electronics, Warsaw Polytechnic Institute, conducted by Agnieszka Wroblewska; date and place not given: "The Good Life or a Career?"]

[Text] [Question] While in the United States I met young Polish electronic experts who stated, that they left Poland to seek opportunities for professional advancement. In your opinion, why didn't they find these opportunities here?

[Answer] I do not know what professional opportunities you have in mind. I believe that the great majority of young people emigrate because of money, to find the kind of standard of living, which here in Poland makes one a member of the elite. Unfortunately, it has come to pass here too, that what you have determines who you are. Living the good life is a prerequisite for feeling good about oneself. Every young person wants to have a large apartment and a late-model car right away.

[Question] Two million people are waiting in line for apartments.

[Answer] The length of the line is a question of unfulfilled hopes, following promises not kept. I do not think that our country has been in a position to ensure housing for every family under the current construction financing conditions.

[Question] Young electronic specialists told me, that they had nothing interesting to work on at their institutes, that they were unable to develop, and that over there they are making a professional career for themselves.

[Answer] What I have learned shows just the opposite. Very few--primarily persons traveling on an official passport--work in a profession. Moreover, they are generally something like scientific immigrant workers, holding auxiliary positions, often exclusively in the field of teaching. They have poor prospects for personal success, and mostly participate in team work. And

there can be no question of brain drain in this case, because in relative terms the contribution they make over there is insignificant.

[Question] Our experience has been different. I know computer specialists who did not distinguish themselves until they went over there. Isn't it sad to see our best people leaving?

[Answer] It is not an occasion for rejoicing, but such instances are exceptional. I know many outstanding specialists who work here under difficult conditions because they love their country. I wouldn't hold back any person who wants to leave from emigrating. We can get along without those who do not come back. Anyway, as I have said, there are only a few persons staying over there for the sake of a professional career. These emigrations are a typically economic exodus today. There is another turn of events that is downright dramatic. Young specialists go to West Germany for a few years, earn a moderate amount of money in a good currency. They take advantage of the exchange rate difference and become well-off as soon as they return. Then a pension does not interest them and it is not worth their while to work on something relating to the needs of society. They only want to work at what interests them.

[Question] And what they are interested in can bear no relation to the needs of society?

[Answer] Different things happen. Others, for example, persons returning from the Arab countries, are not much help at all, because they have gotten out of touch. Electronics has gone ahead without them.

[Question] Have you eliminated these trips abroad?

[Answer] No. What I would rather do is create a different system of values. People should be reminded that man lives much more happily when he is convinced that his work is meaningful to others than when he gets more money.

[Question] But if young electronic specialists see that what they are working on has no chance of being put to use, how is it possible to convince them that their work is meaningful? Can they be enthusiastic about work that is relegated to the file cabinet?

[Answer] They can. What is important is choice of an ambitious and socially useful goal. Practical application work in Poland is often a labor of Sisyphus, but precisely such struggle is exciting to many. Through the example of my own institute, I see that people wax enthusiastic about solving such problems, and they do not ask questions about time or money. This does not happen in the West. There, in Silicon Valley, for example, the object is exclusively to achieve financial success, and it is difficult to imagine anyone working for the pure satisfaction of doing something important. But we have such specialists here in Poland, even though there are fewer and fewer of them.

[Question] Can't professional satisfaction be combined with material satisfaction?



[Answer] The effort should be made, but you must also remember that we will not catch up with the developed countries in potential for satisfying material needs. The thing to do is to establish a different hierarchy of values, to learn to derive satisfaction from what is accomplished. A person achieves high labor productivity by acting under economic pressure. In a system in which such pressure exists, productivity is obviously higher than in a system where psychological comfort, greater leeway, and less stress prevail. In Poland people often say that they would like to work under conditions of economic pressure and have more results, but when it comes time to make a decision, they choose the less stressed conditions. An average raise of 2,500 zlotys per person was approved in one of our departments, the distribution principles being left up to the staff. They debated and debated, and ultimately decided to share equally.

[Question] No one wanted to offend his colleagues?

[Answer] This is a result of mass psychology. In this form of democracy, social priorities, human factors, and so forth manifest themselves all at the same time. We have a condition of psychological comfort, and naturally productivity will decline when this comfort is present. A decision has to be made to do something. If we talk in a circle about increasing efficiency but fail to introduce economic pressure in the capitalist sense, we are merely engaging in idle talk. On the other hand, if we come to the conclusion that we will reject economic pressure and maximization of profit because this conflicts with humanistically understood needs of man, we will have to reconcile ourselves to lower productivity.

[Question] And what do you advocate?

[Answer] I am against the principle of maximizing profit at any cost. I also think that an insane pursuit of ever increasing productivity creates the threat of major social problems. Soon man will not have anything to do on earth, to say nothing of the fact that relentless pursuit of profit leads to stimulation of often fictitious needs simply so that a manufacturer can make a profit.

Young people emigrating in pursuit of professional success are not aware of the psychological stresses involved in work in establishments over there. The majority of them do return. Even some who leave to work with Polish emigre firms, where customs in the capitalist style prevail, come back. When they have to swallow their pride and grind out IBM PC software packages, they prefer to do what they like at research institutes, or at most do additional work on their own in the afternoon.

In my opinion, the form of development proposed by the West does not lead anywhere. I believe that it is possible deliberately to accept a somewhat slower pace of growth in favor of greater psychological ease.

[Question] I am afraid that is not possible. After all, people want to achieve more and more, and so they have to be artificially restrained. You can tie one hand behind the back or put weights on the legs, or you can keep productivity low, as we are doing, but does this ensure human happiness?

[Answer] It is not a question of holding back. It is a question of deliberate choice between the degree of coercion and the level of productivity. Every person makes such a choice, the one who goes abroad to work for an emigre firm and the one who hides himself away in a research institute. The point is that we give consideration to the need for maximum development of man. Consequently, raises "to make things equal" are incomprehensible to me. But we must remember that satisfying human needs does not consist of multiplying things. The West has reached a state such that further technological development will be directed against man. Man is happy when he is active. And if robots start producing robots, man will become superfluous. This will give rise to major social conflicts.

[Question] If someone had been told in the last century that 3 percent of society produces 130 percent of the food, as is currently the case in the United States, he would have considered the person telling him this a lunatic. I do not believe that the development of technology brings only unhappiness with it. On the other hand, retarded development is something unnatural.

[Answer] At present we have slowed down so much that we should rather speed up a bit, but not run after productivity with a Western-style flowchart which sets a fast pace out of a desire for profit. We should select protected areas, as we did in the 1950's, for example. On the assumption that we cannot produce everything, we must give some thought to the subject of where we should concentrate our efforts. For example, we should make one kind of videocassette recorder, one kind of television set, and on the other hand produce more medical equipment.

[Question] And do you believe that everything can be planned from the top, and the plan then followed like a timetable for trains? Such a system does not stimulate any technical progress and kills all initiative. You can plan to satisfy only needs which were conceived of long ago.

[Answer] It is not a question of planning everything. It is necessary to devise mechanisms which will induce sensible action for the good of society. In the system over there, social goals are not important. The capitalist manufacturer concentrates exclusively on making as much profit as possible. Socialism is different, and so we should try not for blind increase in productivity but for a system which will allow more sensible application of the planned approach.

[Question] There must be some sort of motive force in the system to cause action. Under capitalism this motive force is profit. What could be substituted for it?

[Answer] Our system began to devise new mechanisms. People became accustomed to universal education and their personalities were enriched. In the 1950's and later, the inclination toward development of the personality was stronger than toward material development. But in the 1970's a drive toward affluence began, an ambition to make oneself equal to the richest, even though this was impossible, and it obscured other goals. There were sayings such as "the good party activist is one who is successful." This aroused a possessive mindset, and it was not always possible to become the owner of things by normal means.

The 1970's led to a sick mental attitude on the part of society. The departures of young people in a search for better paying work, no matter what it might be, are a result of this sickness. Sociologists should now be set to work thinking about how to extricate ourselves from this dilemma. We should create positive personal models and reform the economy so that people will be paid in accordance with the contribution they make in the form of work.

[Question] But what if someone begins to work very hard and earn a lot and someone else envies him and also makes a greater effort out of a desire for gain? Is this to be interpreted as action in keeping with psychological comfort and restriction of productivity?

[Answer] Let every person choose what he wants. Activity can be channeled toward doing sensible things which bring professional satisfaction. We have people in this country who prefer to solve problems that are important from the social viewpoint than slave to make a lot of money. These attitudes should be made more widespread. Moral motives can win out over commercial motives.

[Question] This sounds like a dream of a better world. It is a shame it has not yet come true. Incidentally, it would be interesting if readers themselves were to tell why so many technicians choose to work under a system of which economic pressure is an inseparable part.

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CSO: 2602/14

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